MARLBORO, VERMONT - BRF 010-1(43)

REPLACEMENT OF EXISTING ROUTE 9 BRIDGE WITH RELATED ROADWAY APPROACH AND CHANNEL WORK

BARRIERGUARD 800
Minimum Deflection System

Prepared for:
Thomas Barriers, LLC.
Framingham, MA

Prepared by:
BETA Group, Inc.
315 Norwood Park South
2nd Floor
Norwood, MA 02062

February 26, 2014

BETA
ENGINEERING SUCCESS TOGETHER

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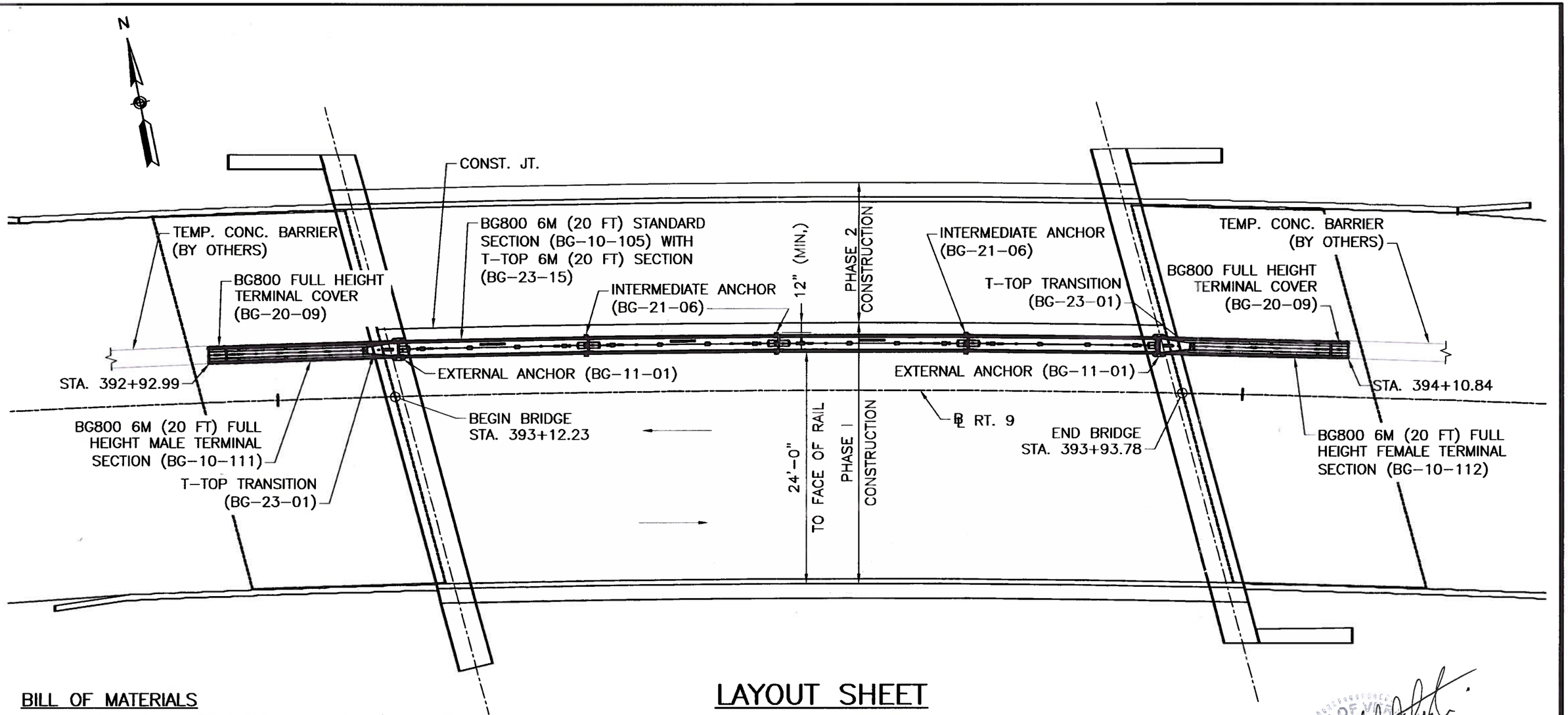
BarrierGuard 800 Layout (Sheet 1 of 1)

Attachments

Federal Highway Administration Letter HSSD/B-158

Highway Care, Ltd Standard Drawings (PennDOT)



BILL OF MATERIALS

2 EA – BG800 FULL HEIGHT TERMINAL COVER (BG–20–09)
1 EA – BG800 6M (20 FT) FULL HEIGHT MALE TERMINAL SECTION (BG–10–111)
1 EA – BG800 6M (20 FT) FULL HEIGHT FEMALE TERMINAL SECTION (BG–10–112)
4 EA – BG800 6M (20 FT) STANDARD SECTION (BG–10–105)
4 EA – T–TOP 6M (20 FT) SECTION (BG–23–15)
2 EA – T–TOP TRANSITION (BG–23–01)
3 EA – INTERMEDIATE ANCHOR (BG–21–06)
2 EA – EXTERNAL ANCHOR (BG–11–01)
8 EA – FLAT TOP ANCHOR PIN (BG–21–12)
14 EA – 1" DIA. MECHANICAL KWIK BOLT 3 ANCHORS (CARBON STEEL) (6" MIN. EMBED.)

LAYOUT SHEET

GRAPHIC SCALE

10 7.5 5 2.5 0 5 10 20
(IN FEET)
1 inch = 10 ft.

STATE OF VERMONT
KENNETH [illegible]
No. 018-0008036
CIVIL
LICENSED
PROFESSIONAL ENGINEER

BETA Group, Inc.
Engineers•Planners•Landscape Architects•Scientists
315 Norwood Park South, Norwood, MA 02062

Rev.	Details.	Date.
0	For Approval	2/26/2014

Title: MARLBORO BRF 010–1(43) BARRIERGUARD 800 LAYOUT
Project – 4277
DWG No. BG–800
11x17 Landscape | DO NOT SCALE | ALL DIMENSIONS IN FEET & INCHES [mm]
Revision –
SHEET 1 OF1
Status | Review

Attachments

Federal Highway Administration Letter HSSD/B-158

Highway Care, Ltd Standard Drawings (PennDOT)

U.S. Department of Transportation
Federal Highway Administration

400 Seventh St., S.W.
Washington, DC 20590

May 8, 2007

In Reply Refer To:
HSSD/B-158

Mr. Owen S. Denman, P.E.
President and CEO
Barrier Systems Inc.
180 River Road
Rio Vista, CA 94571-1208

Dear Mr. Denman:

Thank you for your letter of December 18, 2006, requesting the Federal Highway Administration's (FHWA) acceptance of the **BarrierGuard™ 800 (BG 800) - Minimum Deflection System** of Highway Care, Ltd. and Laura Metaal Eygelshoven, BV, for use on National Highway System under the provisions of the National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features". Accompanying your letter was a report on testing of the BarrierGuard™ 800 - Minimum Deflection system prepared by Safe Technologies Inc, test videos, drawings and previously prepared crash test reports providing additional information and background, including report on crash testing of regular BarrierGuard™ 800 system of October 2004 and report on crash testing of BarrierGuard™ 800 with Intermediate Anchors of October 2005.

Requirements
Longitudinal barrier systems should meet the guidelines contained in the NCHRP Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features". FHWA Memorandum "ACTION: Identifying Acceptable Highway Safety Features" of July 25, 1997 provides further guidance on crash testing of longitudinal barriers.

Product description
The previously approved BarrierGuard™ 800 system (acceptance letter HSA-10/B-131) is a high containment and low deflection steel barrier designed for both permanent applications and temporary use in roadwork situations, preventing penetration of errant vehicles into working areas. It is constructed from 5-mm (0.2") thick A36 galvanized steel panels assembled in either 6-meter (19.7 ft) or 12-meter (39.4 ft) segments. Each segment is 800-mm (31.5") high with a base width of 540 mm (21") and a top width of 230 mm (9"). The BarrierGuard™ 800 has a

sloped face with a "step" 255 mm (10”) above the ground. Each 12 meter segment weighs approximately 1080 kg (2381 lb). The system is anchored at each end and at a point approximately 6 m (20 ft) in from each end. The test level 3 (TL-3) dynamic deflection of the BarrierGuard^{TM} 800 system was reported to be 1000 mm (39.4”) for Test 3-21 conditions and estimated to be 1500 mm (78.8”) for Test 3-11 conditions.

The BarrierGuard^{TM} 800 - Minimum Deflection system is a modification of the previously approved BarrierGuard^{TM} 800 system designed to minimize the dynamic deflection of the system. Minimum Deflection systems are valuable in application where there is only limited space available, such as bridge deck repairs/replacement projects. To achieve this reduction in deflection, BarrierGuard^{TM} 800 - Minimum Deflection system incorporates the following modifications to the standard BarrierGuard^{TM} 800:

- The barrier is anchored every 6 m (20 ft) with either joint anchors or intermediate anchors.
- The system consists of either 6 m (20 ft) or 12 m (40ft) BarrierGuardTM 800 sections.
- The barrier sections are fitted with a T-top attachment to aid in the redirection and stability of the vehicle after impact. The T-top measures 473mm (15 5/8”) wide and is 121mm (4 3/4”) tall. The effective width of the top section with the T-top installed is 474 mm (18 5/8”). With the T-top installed the barrier height is 921mm (36 1/16”) and the mass of each 6 meter (20 ft) BarrierGuard^{TM} 800 section is approximately 135 kg per meter (90 lb/ft) or 800 kg (1800 lb). The mass of a similar 12 meter (40 ft) section is approximately 135 kg per meter (90 lb/ft) or 1600 kg (3600 lb).

Drawings of the BarrierGuard^{TM} 800 - Minimum Deflection system are provided in Enclosure 1.

Test article installation
The barrier installation consisted of eight 6 meter (20ft) sections for a total length of 48 meters (157 ft). The test article configuration and layout, including points of intersection, anchorage and impact, are summarized in the drawing provided in Enclosure 1.

Testing
The NCHRP Report 350 requires that in order for the length-of-need of longitudinal barriers to meet the NCHRP Report 350 TL-3 criteria they must successfully pass tests 3-10 and 3-11 while test S3-10 is optional. However, since your company’s regular BarrierGuard^{TM} 800 system (without intermediate anchors) was fully tested and approved before (acceptance letter HSA-10/B-131), you ran only test 3-11 on the BarrierGuard^{TM} 800 - Minimum Deflection system. The assumption was that this test will be more critical than the test 3-10 since it will deliver the maximum load to the anchor point and connection and evaluate the strength of the system in containing and redirecting the 2000P test vehicle.

Taking into account that previous 3-10 comparable crash tests on regular BarrierGuard^{TM} 800 system recorded occupant impact velocities and ridedown accelerations well below the maximum limits (6 m/s and 9.6 g, respectively), it can be reasonably assumed that while increase in lateral stiffness of the barrier provided by BarrierGuard^{TM} 800 - Minimum Deflection system may lead to an increase in the occupant risk values, they will remain within the maximum NCHRP 350 limits. I therefore agree that test 3-10 on the BarrierGuard^{TM} 800 - Minimum Deflection system is redundant and can be waived.

The full-scale NCHRP Report 350 Test 3-11 conducted on your company's BarrierGuard™ 800 - Minimum Deflection system involved a 2000P vehicle impacting the device at 101.4 km/h and 25.0 deg. angle with the impact point 23 meters (76 ft) from the upstream end at a section joint and anchor point. The test vehicle impacted the article, was redirected away from the barrier, and lost contact with the barrier downstream from the impact point at a velocity of 72.4 km/h and an angle of 14 degrees.

The impacted and the downstream barrier sections received moderate damage at the T-top and anchor assembly. The barrier was dented in the impact area, but did not separate or tear. The anchors upstream and downstream from the impact did not lift or crack the concrete or asphalt. The total permanent deflection was 19mm (0.75") at the base and 203 mm (8") at the T- top and the total dynamic deflection was 76mm (3") at the base and 305 mm (12") at the T-top.

All occupant risk factors were within the limits specified in NCHRP Report 350. The theoretical occupant impact velocity values in the longitudinal and lateral directions were 5.9 and 6.5 m/s respectively and the theoretical occupant ridedown acceleration values in the longitudinal and lateral directions were 5.5 and 7.8 g's respectively. A summary of the test results is provided in Enclosure 2.

It is my understanding that you also intending to use the BarrierGuard™ 800 - Minimum Deflection system with the intermediate anchoring every 12 m instead of 6 m. In October 2005 you conducted test 3-11 on the similar system with intermediate anchors every 12 m, however without T-top. While all evaluation criteria were met, the pitch angle was somewhat higher than in free standing tests previously submitted. I therefore agree that if this system is used with the T-top, as BarrierGuard™ 800 - Minimum Deflection system with anchoring every 12 m, its performance will be acceptable. Of course, maximum permanent and dynamic deflection will increase compared to the BarrierGuard™ 800 - Minimum Deflection system anchored every 6 m. The estimated deflection for the system with a T-top and 12 m anchors is less than that observed in the 3-11 test conducted without the T-top, approximately 890 mm (35").

From the documentation accompanying your request for acceptance it is clear that you also request the acceptance of applications where regular BarrierGuard™ 800 system (without intermediate anchors and T-top) and BarrierGuard™ 800 - Minimum Deflection system are used in combinations, provided that transitions are used. You specified that to provide such transitions T-top is to begin a min of 12 m (39.4 ft) prior to any anchor and run a minimum 12 m (39.4 ft) past anchors with T-top transition sections extending additional 1.5 m (4.9 ft). No specific tests were conducted to test these transitions, however test 3-21 on the regular BarrierGuard™ that you successfully conducted in October 2004 (acceptance letter HSA-10/B131) is relevant to predict crash performance of such transitions. In that test the impact point was selected 15 m (49.2 ft) from the downstream end of the system, which was anchored at two points - at the end and 6 m (20 ft) in from the end. Thus, this impact point was located at the transition from freestanding and anchored sections of the barrier. Taking into account that this 3-21 test was successful and that you also propose the use of T-top as an additional treatment smoothening stiffness changes in the transitions between freestanding and anchored sections, I agree that full crash testing of transitions between BarrierGuard™ 800 system (without intermediate anchors and T-top) and BarrierGuard™ 800 - Minimum Deflection systems would be redundant.

In summary I agree that BarrierGuard^{TM} 800 - Minimum Deflection system, as described above, meets the appropriate evaluation criteria for the NCHRP 350 TL-3 longitudinal barriers and may be used at all appropriate locations on the NHS when selected by the contracting authority, subject to the provisions of Title 23, Code of Federal Regulations, Section 635.411 as they pertain to proprietary products. It can also be used with intermediate anchoring every 6m or 12 m when using the T-top adaptor and in combinations with regular BarrierGuard^{TM} 800 provided that proper transitions are used and changes in deflections are taken into account. This acceptance is based on the reported crash performance of the BarrierGuard^{TM} 800 - Minimum Deflection system. Further, I am assuming that production models will be identical to the prototype test units.

Standard provisions
Please note the following standard provisions that apply to the FHWA letters of acceptance:

- This acceptance is limited to the crashworthiness characteristics of the devices.
- Any changes that may adversely influence the crashworthiness of the device will require a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the device being marketed is significantly different from the version that was crash tested, it reserves the right to modify or revoke its acceptance.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance, and that they will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance, designated as number B-158, shall not be reproduced except in full. This letter, and the test documentation upon which this letter is based, is public information. All such letters and documentation may be reviewed at our office upon request.
- The BarrierGuardTM 800 - Minimum Deflection system is a patented product and considered proprietary. If proprietary devices are specified by a highway agency for use on Federal-aid projects, except exempt, non-NHS projects, they: (a) must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with the existing highway facilities or that no equally suitable alternative exists; or (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411.
- This acceptance letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented device for which the applicant is not the patent holder. The acceptance letter is limited to the crashworthiness characteristics of the candidate device, and the FHWA is neither prepared nor required to become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.

- Since BarrierGuard^{TM} 800 - Minimum Deflection system is a steel product, the provisions of Title 23, Code of Federal Regulations Section 635.410 (a copy of which is enclosed) are applicable. Note that the "Buy America" provisions apply only to steel products that are permanently incorporated into highway projects, not to temporary barriers used only during construction or maintenance operations.

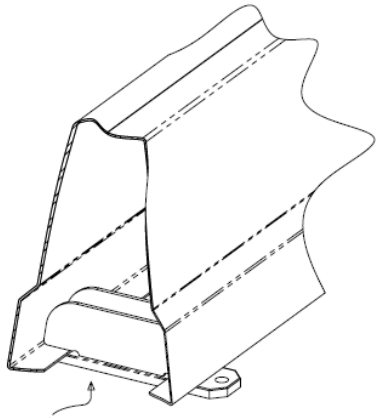
Sincerely yours,

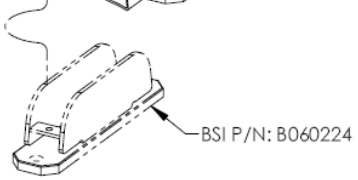
George E. Rice, Jr.
Acting Director, Office of Safety Design
Office of Safety

Enclosures

DYNAMIC DEFLECTION TL-3				
ANCHORAGE	in		mm	
STANDARD	59		1,500	
12m [40 ft]	35		890	
6m [20 ft]	TOP	BASE	TOP	BASE
	12	8	305	200

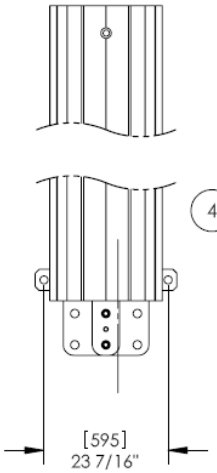
Item	Qty	Part Description	Part#	U/M
1	1.00	ANCHOR PLATE WELDMENT, BG800	B060982	EACH
2	2.00	C-SCR HH M24-3.0x120 CL8.8 GAL	2001562	EACH
3	2.00	Washr M24 Gal	2001563	EACH
4	2.00	Nut HN M24-3.0 Gal	2001565	EACH

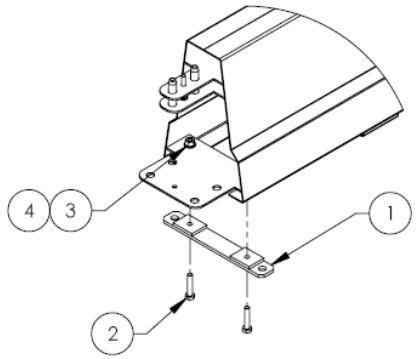




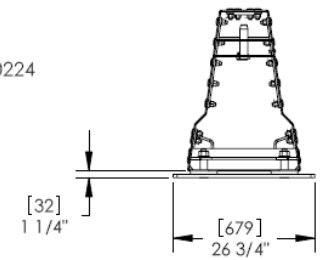
DETAIL B
SCALE 1 : 12

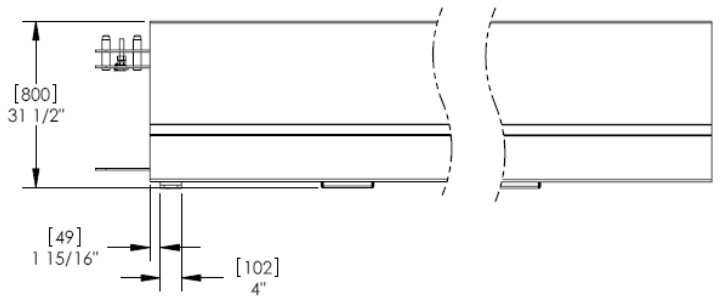
(INTERMEDIATE ANCHOR, INSTAL BETWEEN QUICK-CONNECT POINTS)





(INSTALLATION AT QUICK-CONECT)





NOTES: UNLESS OTHERWISE SPECIFIED

1. INTERMEDIATE ANCHORS MAY BE INSTALLED TO REDUCED DEFLECTION.
2. T-TOP SHALL BE INSTALLED ON BARRIER GUARD SECTIONS WHEN INTERMEDIATE ANCHORS ARE USED. T-TOP IS TO BEGIN A MIN OF 12m PRIOR TO ANY ANCHOR AND RUN A MINIMUM 12m PAST ANCHORS. TRANSITION SHALL EXTEND AND ADDITIONAL 1.5m.

NOTE:
THICKNESS OF WELD TO BE EQUAL TO THE THINNER OF 2 PIECES BEING JOINED. WELD TO BE ALL AROUND UNLESS OTHERWISE SPECIFIED

REV.	CHANGES	DATE	BY	REQD	NEXT ASSY.	ITEM
1	ADDED TABLE "DYNAMIC DEFLECTION" ADDED DETAIL "B"	12/05/06	AEM			

SCALE: 1:20

Standard Tolerance
Angular +/- 1/2 Deg
Fractional +/- 1/16
Dec. XXX=+/- .010
Dec. XX=+/- .030

	DATE	INIT.
DRAWN BY	11/7/05	CMB
		GAD

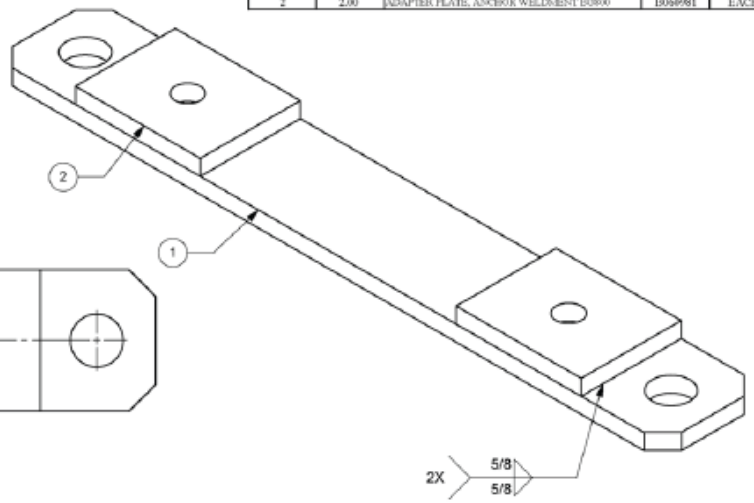
TITLE: INTERMEDIATE ANCHOR INSTALLATION

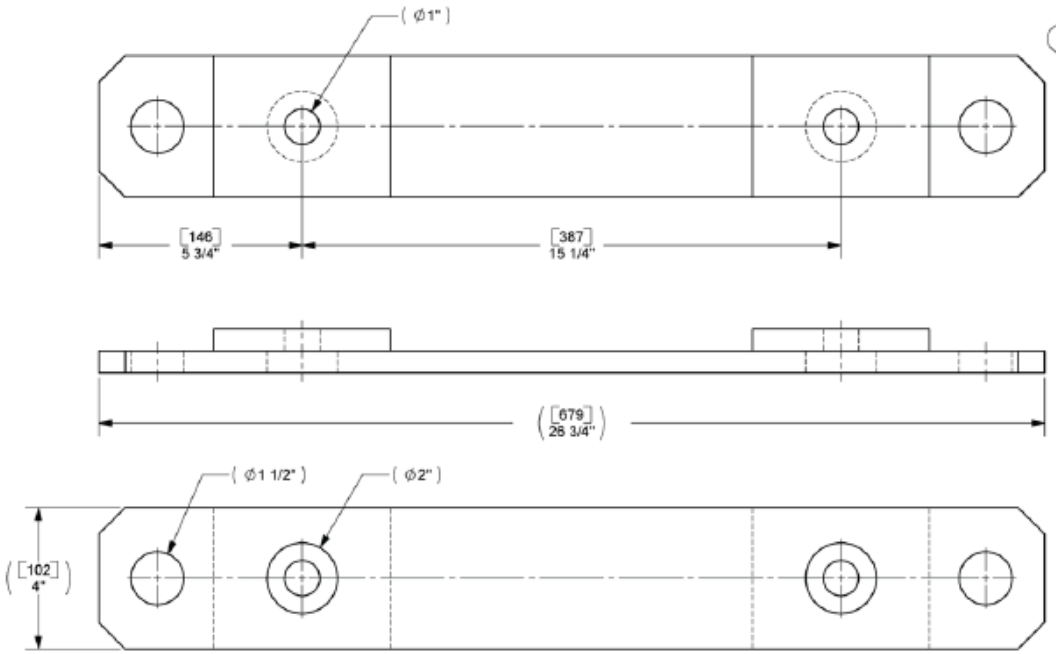
MODEL	DRAWING NUMBER	REV
	B051103	1

NOTES: UNLESS OTHERWISE SPECIFIED

1. FINISH TO BE HOT DIPPED GALVANIZED PER ASTM A123.
2. ALL HOLES TO BE FREE OF WELD SPATTER.

Item	Qty	Part Description	Part#	UM
1	1.00	ANCHOR PLATE, BG800	B060980	EACH
2	2.00	ADAPTER PLATE, ANCHOR WELDMENT BG800	B060981	EACH





NOTE:
THICKNESS OF WELD TO BE EQUAL TO THE THINNER OF 2 PIECES BEING JOINED. WELD TO BE ALL AROUND UNLESS OTHERWISE SPECIFIED

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REQ'D	NEXT ASSY.	ITEM

SCALE: 1:3

	DATE	INIT.
DRAWN BY	9/28/06	AEM
APPR'D BY		

Standard Tolerance
Angular ± 1/2°
Fractional ± 1/16"
Dec .XXX± ± .010
Dec .XX± ± .030

TITLE:
ANCHOR PLATE WELDMENT, BG800

BARRIER SYSTEMS INC
180 RIVER RD, RIO VISTA, CA 94571
TEL: 707-374-6800 FAX: 707-374-6801

SHEET	DRAWING NUMBER	REV
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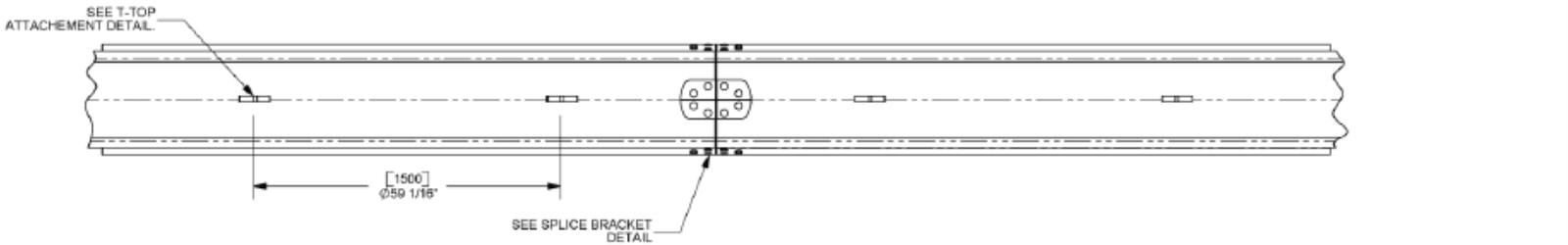
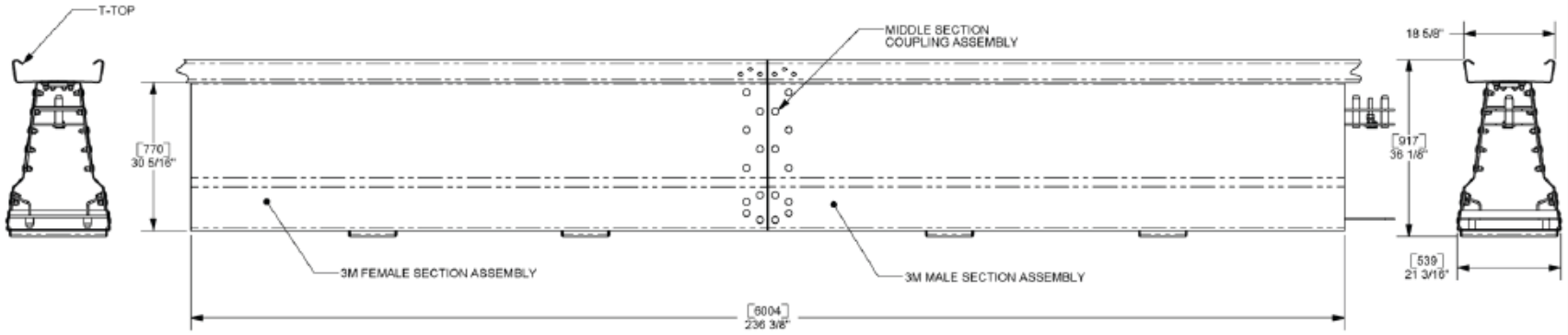
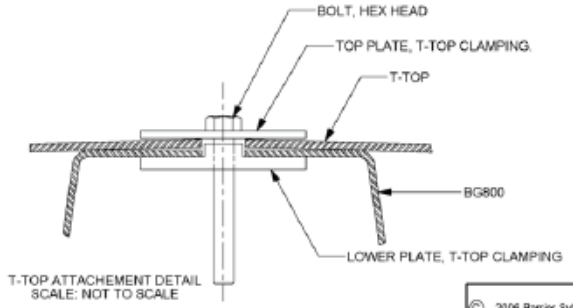
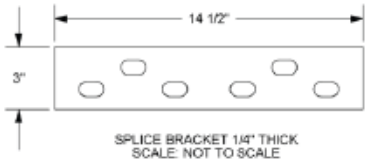






T-TOP ATTACHEMENT DETAIL
SCALE: NOT TO SCALE



SPLICE BRACKET 1/4" THICK
SCALE: NOT TO SCALE

NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS SHOWN ARE REFERENCE. DIMENSIONS IN BRACKETS ARE mm.
2. 6 METER BG SECTION SHOWN WIT T-TOP INSTALLED.
3. T-TOP IS IN 6m [20'] SECTIONS AND ATTACHES WITH HARDWARE SHOWN EVERY 1.5m [59"]. T-TOPS ARE SPLICED TOGETHER WITH BRACKETS SHOWN.
4. T-TOP IS REQUIRED WHEN BARRIER GUARD SECTION IS USED IN CONJUNCTION WITH INTERMEDIATE ANCHORING, GATE SECTIONS, AND/OR VARIABLE LENGTH BARRIERS (BGVLB). T-TOP SHOULD EXTEND 12m ON EITHER SIDE FO THESE CONDITIONS AND BE TERMINATED WITH A TRANSITION SECTION.

NOTE:
THICKNESS OF WELD TO BE EQUAL TO THE THINNER OF 2 PIECES BEING JOINED. WELD TO BE ALL AROUND UNLESS OTHERWISE SPECIFIED

REV.	CHANGES	DATE	BY
0	NEW DRAWING	11/17/06	AEM

REQ'D	NEXT ASSY.	ITEM

SCALE: 1:20

	DATE	INIT
DRAWN BY	11/17/06	AEM
APPR'D BY		

Standard Tolerance
Angular ± 1/2°
Fractional ± 1/16"
Dec .XXX± ± .010
Dec .XX± ± .030

TITLE:
6m T-TOP, BARRIER GUARD 800 ASSEMBLY

BARRIER SYSTEMS INC
180 RIVER RD, RIO VISTA, CA 94571
TEL: 707-374-6800 FAX: 707-374-6801

SHEET	DRAWING NUMBER	REV
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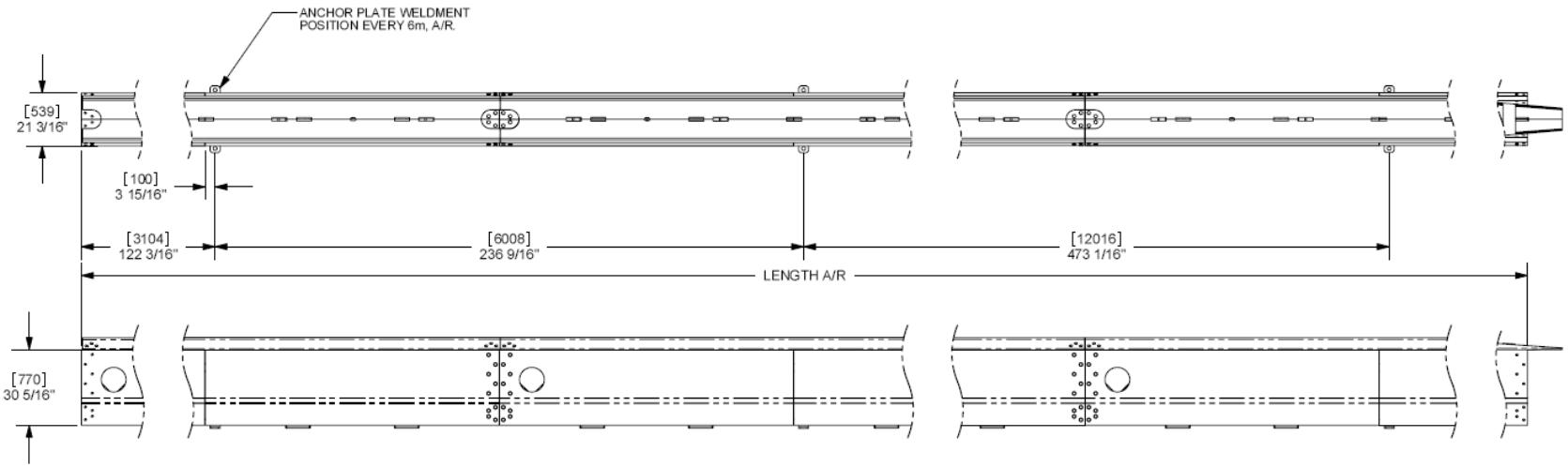

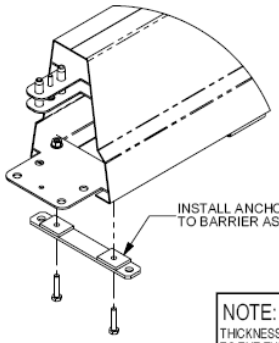

DETAIL A
SCALE 1 : 20

NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS SHOWN ARE REFERENCE DIMENSIONS IN BRACKETS ARE mm.
2. BARRIER GUARD SYSTEM SHOWN WITH 6 METER SEGMENTS ANCHORED EVERY 6m.
3. BARRIER GUARD MAY BE DEPLOYED IN 6m OR 12m [20, OR 40'] SECTIONS ANCHORED WITH INTERMEDIATE ANCHORS INSTALLED TO MINIMIZE DEFLECTION.
4. T-TOP IS TO BEGIN A MINIMUM OF 12m PRIOR TO ANY ANCHOR, GATE OR VLB, AND RUN A MINIMUM OF 12m PAST ANCHORS. TRANSITION SHALL EXTEND AN ADDITIONAL 1.5m.

NOTE:
THICKNESS OF WELD TO BE EQUAL TO THE THINNER OF 2 PIECES BEING JOINED. WELD TO BE ALL AROUND UNLESS OTHERWISE SPECIFIED

REV.	CHANGES	DATE	BY	REQ'D	NEXT ASSY.	ITEM
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SCALE: 1:1

	DATE	INIT.
DRAWN BY	11/17/06	AEM
APPR'D BY		

Standard Tolerance
Angular ± 1/2°
Fractional ± 1/16"
Dec .XX= ± .010
Dec .XX= ± .030

TITLE:
T-TOP TRANSITION DETAIL ASSEMBLY
ANCHORED

BARRIER SYSTEMS INC
180 RIVER RD, RIO VISTA, CA 94571
TEL: 707-374-6800 FAX: 707-374-6801

SHEET	DRAWING NUMBER	REV
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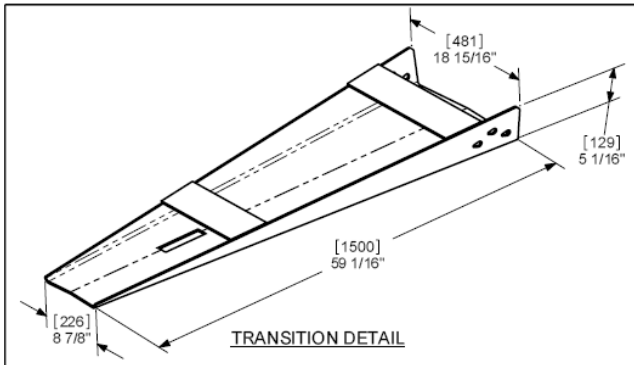
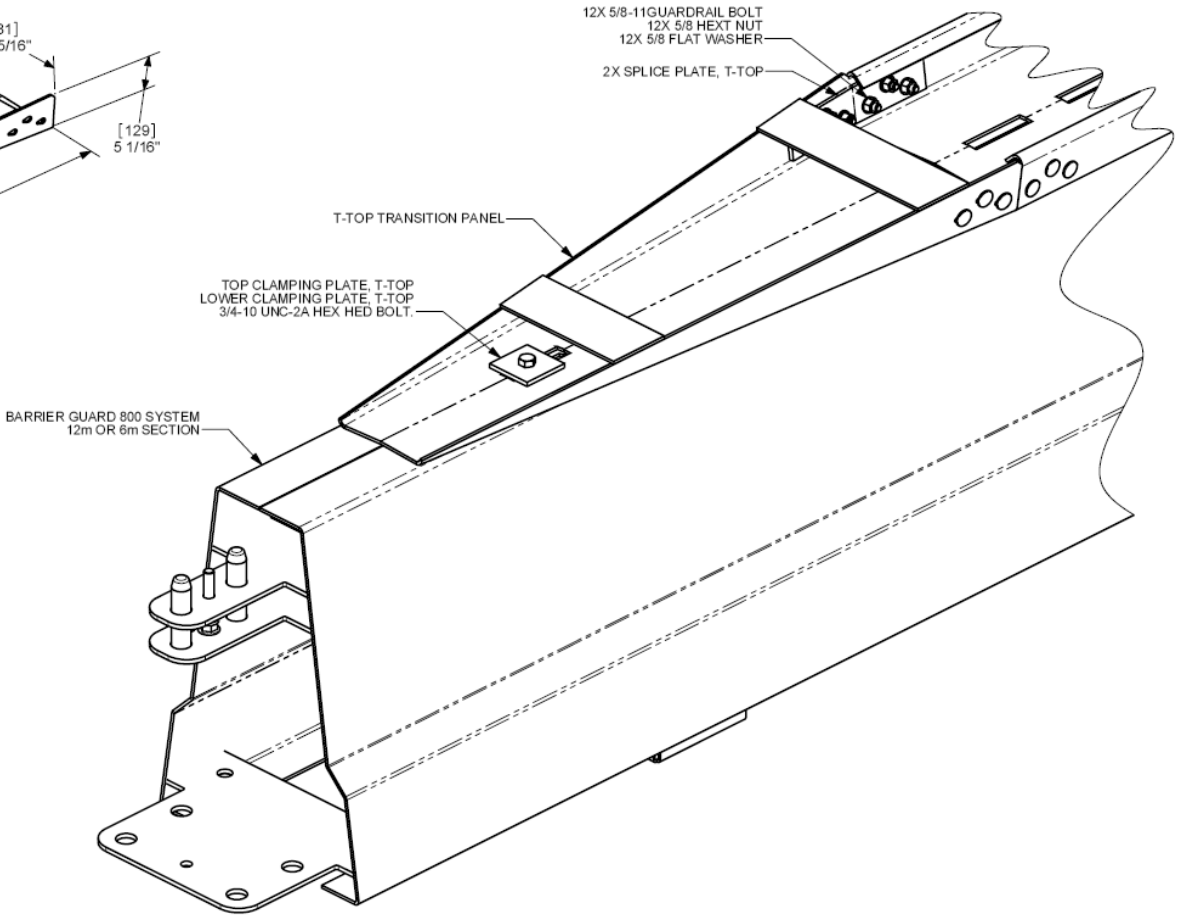


TRANSITION DETAIL



NOTE:
THICKNESS OF WELD TO BE EQUAL TO THE THINNER OF 2 PIECES BEING JOINED. WELD TO BE ALL AROUND UNLESS OTHERWISE SPECIFIED

REV.	CHANGES	DATE	BY	REQ'D	NEXT ASSY.	ITEM
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SCALE: 1:8

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DRAWN BY	1/16/07	AEM
APP'RD BY		

Standard Tolerance
Angular ± 1/2°
Fractional ± 1/16"
Dec .XXX= ± .010
Dec .XX= ± .030

TITLE: T-TOP TRANSITION DETAIL ASSEMBLY

BARRIER SYSTEMS INC
180 RIVER RD, RIO VISTA, CA 94571
TEL: 707-374-6800 FAX: 707-374-6801

SHEET	DRAWING NUMBER	REV
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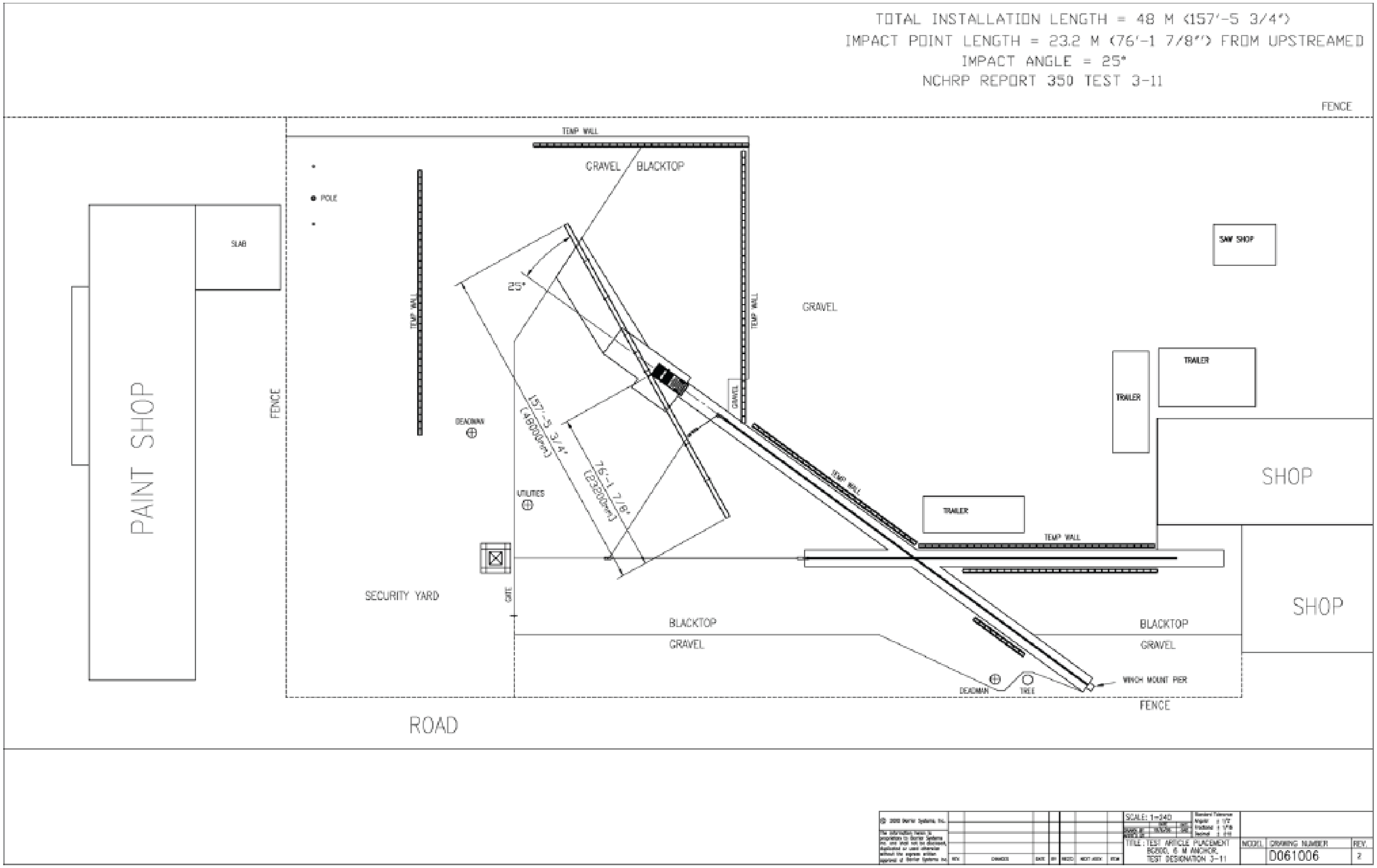
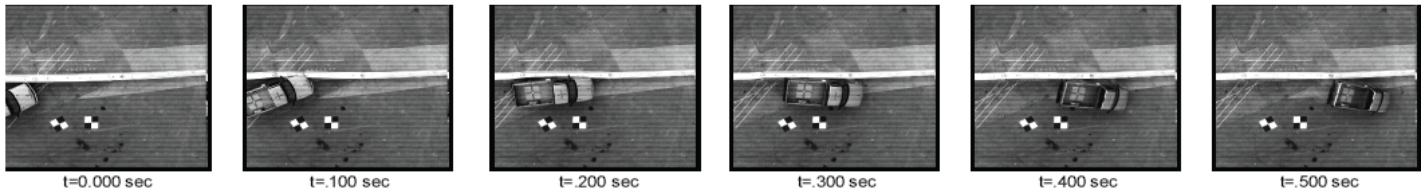
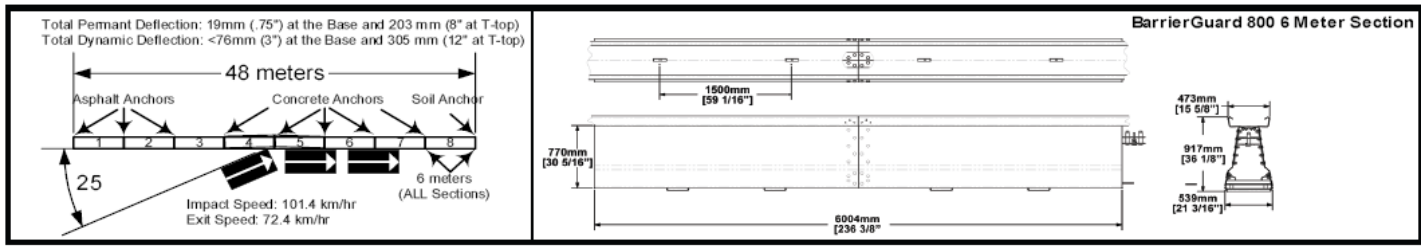

TOTAL INSTALLATION LENGTH = 48 M (157'-5 3/4")
IMPACT POINT LENGTH = 23.2 M (76'-1 7/8") FROM UPSTREAMED
IMPACT ANGLE = 25°
NCHRP REPORT 350 TEST 3-11
FENCE
TEMP WALL
GRAVEL
BLACKTOP
POLE
SLAB
PAINT SHOP
TEMP WALL
25°
TEMP WALL
GRAVEL
SAW SHOP
TRAILER
TRAILER
FENCE
DEADMAN
157'-5 3/4'
(48000mm)
76'-1 7/8'
(23200mm)
TEMP WALL
SHOP
UTILITIES
TRAILER
TEMP WALL
SECURITY YARD
GATE
BLACKTOP
GRAVEL
SHOP
BLACKTOP
GRAVEL
DEADMAN
TREE
WINCH MOUNT PIER
FENCE
ROAD
SCALE: 1=240
TITLE: TEST ARTICLE PLACEMENT BG800, 6 M ANCHOR, TEST DESIGNATION 3-11
MODEL
DRAWING NUMBER
D061006
REV.
2





General Information

Test Agency	**SAFE TECHNOLOGIES, INC.**
Test Designation	**NCHRP Report 350 3-11**
Test No.	**STI Test #BG808**
Date	11/1/2006

Test Article

Type	BarrierGuard 800 steel barrier
Installation Length	Total Barrier Length : 48 meters (157')
Size and/or dimension and material of key elements	Segment Lengths: 6 meters (20') Height: 800mm (31.5") @ T-top 921mm (361/4" Width (base) 540mm (21 1/4") width (T-top) 474mm (18 5/8")

Test Vehicle

Type	Production Model
Designation	2000P
Model	2000 Chevrolet 3/4 ton pickup
Mass (kg)	
Curb	2120
Test Inertial	2023
Dummy(s)	n/a
Gross Static	2023

Impact Conditions

Speed (km/h)	101.4
Angle (deg)	25
Impact Severity (kJ)	143.3

Exit Conditions

Speed (km/h)	72.4
Angle (deg)	14

Occupant Risk Values

Impact velocity (m/s)	
x-direction	5.9
y-direction	-6.5
Ridedown Acceleration (g's)	
x-direction	-5.5
y-direction	7.8
THIV (km/hr)	29.6
PHD (g's)	8.4
ASI	1.11

Test Article Deflection (mm)

Dynamic	305 mm (12") Top / <76mm (3") at Base
Permanent	203 mm (8") Top / 19mm (.75") at Base

Vehicle Damage

Exterior	
VDS	LF-3
CDC	11FYMW4
Interior	
OCDI	LD0010000

Post-Impact Vehicular beharior (deg - gyro @ c.g)

Maximum Roll Angle (before capture)	20
Maximum Pitch angle (before capture)	18
Maximum Yaw Angle (before capture)	14

Title 23, Code of Federal Regulations
§ 635.410 Buy America requirements.

(a) The provisions of this section shall prevail and be given precedence over any requirements of this subpart which are contrary to this section. However, nothing in this section shall be construed to be contrary to the requirements of §635.409(a) of this subpart.

(b) No Federal-aid highway construction project is to be authorized for advertisement or otherwise authorized to proceed unless at least one of the following requirements is met:

(1) The project either: (i) Includes no permanently incorporated steel or iron materials, or (ii) if steel or iron materials are to be used, all manufacturing processes, including application of a coating, for these materials must occur in the United States. Coating includes all processes which protect or enhance the value of the material to which the coating is applied.

(2) The State has standard contract provisions that require the use of domestic materials and products, including steel and iron materials, to the same or greater extent as the provisions set forth in this section.

(3) The State elects to include alternate bid provisions for foreign and domestic steel and iron materials which comply with the following requirements. Any procedure for obtaining alternate bids based on furnishing foreign steel and iron materials which is acceptable to the Division Administrator may be used. The contract provisions must (i) require all bidders to submit a bid based on furnishing domestic steel and iron materials, and (ii) clearly state that the contract will be awarded to the bidder who submits the lowest total bid based on furnishing domestic steel and iron materials unless such total bid exceeds the lowest total bid based on furnishing foreign steel and iron materials by more than 25 percent.

(4) When steel and iron materials are used in a project, the requirements of this section do not prevent a minimal use of foreign steel and iron materials, if the cost of such materials used does not exceed one-tenth of one percent (0.1 percent) of the total contract cost or $2,500, whichever is greater. For purposes of this paragraph, the cost is that shown to be the value of the steel and iron products as they are delivered to the project.

(c)(1) A State may request a waiver of the provisions of this section if;

(i) The application of those provisions would be inconsistent with the public interest; or

(ii) Steel and iron materials/products are not produced in the United States in sufficient and reasonably available quantities which are of a satisfactory quality.

(2) A request for waiver, accompanied by supporting information, must be submitted in writing to the Regional Federal Highway Administrator (RFHWA) through the FHWA Division Administrator. A request must be submitted sufficiently in advance of the need for the waiver in order to allow time for proper review and action on the request. The RFHWA will have approval authority on the request.

(3) Requests for waivers may be made for specific projects, or for certain materials or products in specific geographic areas, or for combinations of both, depending on the circumstances.

(4) The denial of the request by the RFHWA may be appealed by the State to the Federal Highway Administrator (Administrator), whose action on the request shall be considered administratively final.

(5) A request for a waiver which involves nationwide public interest or availability issues or more than one FHWA region may be submitted by the RFHWA to the Administrator for action.

(6) A request for waiver and an appeal from a denial of a request must include facts and justification to support the granting of the waiver. The FHWA response to a request or appeal will be in writing and made available to the public upon request. Any request for a nationwide waiver and FHWA's action on such a request may be published in the Federal Register for public comment.

(7) In determining whether the waivers described in paragraph (c)(1) of this section will be granted, the FHWA will consider all appropriate factors including, but not limited to, cost, administrative burden, and delay that would be imposed if the provision were not waived.

(d) Standard State and Federal-aid contract procedures may be used to assure compliance with the requirements of this section.

Title 23, Code of Federal Regulations
§ 635.411 Material or product selection.

(a) Federal funds shall not participate, directly or indirectly, in payment for any premium or royalty on any patented or proprietary material, specification, or process specifically set forth in the plans and specifications for a project, unless:

(1) Such patented or proprietary item is purchased or obtained through competitive bidding with equally suitable unpatented items; or

(2) The State transportation department certifies either that such patented or proprietary item is essential for synchronization with existing highway facilities, or that no equally suitable alternate exists; or

(3) Such patented or proprietary item is used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes.

(b) When there is available for purchase more than one nonpatented, nonproprietary material, semifinished or finished article or product that will fulfill the requirements for an item of work of a project and these available materials or products are judged to be of satisfactory quality and equally acceptable on the basis of engineering analysis and the anticipated prices for the related item(s) of work are estimated to be approximately the same, the PS&E for the project shall either contain or include by reference the specifications for each such material or product that is considered acceptable for incorporation in the work. If the State transportation department wishes to substitute some other acceptable material or product for the material or product designated by the successful bidder or bid as the lowest alternate, and such substitution results in an increase in costs, there will not be Federal-aid participation in any increase in costs.

(c) A State transportation department may require a specific material or product when there are other acceptable materials and products, when such specific choice is approved by the Division Administrator as being in the public interest. When the Division Administrator's approval is not

obtained, the item will be nonparticipating unless bidding procedures are used that establish the unit price of each acceptable alternative. In this case Federal-aid participation will be based on the lowest price so established.

(d) Appendix A sets forth the FHWA requirements regarding (1) the specification of alternative types of culvert pipes, and (2) the number and types of such alternatives which must be set forth in the specifications for various types of drainage installations.

(e) Reference in specifications and on plans to single trade name materials will not be approved on Federal-aid contracts.

(f) In the case of a design-build project, the following requirements apply: Federal funds shall not participate, directly or indirectly, in payment for any premium or royalty on any patented or proprietary material, specification, or process specifically set forth in the Request for Proposals document unless the conditions of paragraph (a) of this section are applicable.

[41 FR 36204, Aug. 27, 1976, as amended at 67 FR 75926, Dec. 10, 2002]

GENERAL NOTES UNLESS OTHERWISE SPECIFIED:

1. THE SYSTEM SHOWN ON THIS DRAWING, BG-62-03, IS A PROPRIETARY BARRIER TRADED AS BARRIERGUARD 800 AND BARRIERGUARD 800 MDS AND HAS BEEN DESIGNED AND MANUFACTURED BY HIGHWAY CARE LTD.

2. THE BARRIERGUARD 800 SYSTEM HAS BEEN CRASH TESTED TO NCHRP 350 AND HAS FHWA APPROVAL AS A TL-3 AND TL-4 BARRIER. THE DEFLECTION TABLE ON PAGE 6 OUTLINES BASIC SYSTEM PERFORMANCE AND COMPONENT ANCHORING REQUIREMENTS.

3. THIS DRAWING PACKAGE PROVIDES THE RELEVANT INFORMATION AND GENERAL GRAPHICS REQUIRED TO IDENTIFY THE COMPONENT PARTS OF BARRIERGUARD 800 AND THEIR INCORPORATION AS A WHOLE SYSTEM FOR DEPARTMENTAL STANDARD APPLICATIONS.

4. BARRIERGUARD 800 REQUIRES ANCHORING (PINNING) AT EACH END OF THE INSTALLED LENGTH. (TO REDUCE DEFLECTION, INTERMEDIATE ANCHORS CAN BE USED WHERE REQUIRED SEE PAGES 2 & 5).

5. INSTALLATION OF BARRIERGUARD 800 OR BARRIERGUARD 800 MDS, NORMALLY STARTS WITH A MALE TERMINAL SECTION (BG-10-11) AND IS FINISHED WITH A FEMALE TERMINAL SECTION (BG-10-12). STANDARD SECTIONS ARE USED BETWEEN THE TERMINAL SECTIONS TO OBTAIN THE REQUIRED LENGTH OF POSITIVE BARRIER PROTECTION.

6. THE FULL HEIGHT TERMINAL (FHT) SECTIONS MAY BE CAPPED WITH A FHT COVER, HOWEVER IF EXPOSED TO ON-COMING TRAFFIC THE END SHOULD BE PROTECTED WITH A SUITABLE CRASH CUSHION. THE BARRIERGUARD 800 RANGE IS COMPATIBLE WITH MOST COMMONLY USED CRASH CUSHION END TREATMENTS. FOR DETAILS OF BARRIERGUARD 800 CRASH CUSHION CONNECTIONS THAT ARE NOT DETAILED WITHIN THESE DRAWINGS, PLEASE CONTACT HIGHWAY CARE LTD FOR MORE DETAILS. THE FULL HEIGHT TERMINAL COVER IS SUITABLE FOR THE "DOWN STREAM" END OF A SYSTEM THAT DOES NOT HAVE EXPOSURE TO ON-COMING TRAFFIC.

7. WHEN INSTALLING EITHER OF THE MINIMUM DEFLECTION SYSTEMS (MDS), THE SYSTEM CAN BE INSTALLED WITH ADDITIONAL INTERMEDIATE ANCHORS AT INTERVALS SHOWN IN THE TABLE ON PAGE 6.

8. THERE ARE SEVERAL METHODS OF ACHIEVING RADIUS IN A LENGTH OF BARRIERGUARD. RADIUS CAN BE ACHIEVED USING VARIOUS METHODS AND THUS ALLOWING THE BARRIERGUARD TO FOLLOW THE DESIRED CURVATURE IN THE INSTALLATION, THESE METHODS ARE, THE MOVEMENT IN THE QUICKLINK , ADJUSTABLE 20FT [6m] SECTIONS OR SHORT ANGLED SECTIONS WHICH ALLOW A RADIUS AS LOW AS 12FT [3.65m]. FOR FURTHER INFORMATION AND ADVICE CONTACT HIGHWAY CARE LTD.

9. A BARRIERGUARD 800 VARIABLE LENGTH BARRIER (VLB) SECTION SHOULD BE USED WHEN BARRIERGUARD 800 OR BARRIERGUARD 800 MDS IS ANCHORED ACROSS A BRIDGE EXPANSION JOINT.IF T-TOP IS TO BE USED IN CONJUNCTION WITH THE VLB, THE T-TOP SHOULD BE USED FOR MINIMUM 40FT [12M] ON EITHER SIDE OF THE VLB AND TERMINATED WITH TRANSITIONS. THE VLB SECTION PROVIDES APPROXIMATELY 7in [178mm] OF EXTENSION AND 7in [178mm] OF CONTRACTION. MULTIPLE VLB'S CAN BE LINKED TOGETHER TO PROVIDE MORE EXPANSION OR CONTRACTION. THE VLB'S SHOULD BE PLACED IN THE VICINITY OF THE EXPANSION JOINT. THE VLB DOES NOT NEED TO BE PLACED DIRECTLY OVER THE EXPANSION JOINT BUT MUST BE BETWEEN THE NEAREST ANCHORS ON EACH SIDE OF THE JOINT. IT IS RECOMMENDED THAT THE VLB IS PLACED WITHIN 40FT [12M] OF THE JOINT.

10. THE T-TOP CAN BE INSTALLED EITHER BEFORE OR AFTER THE BARRIERGUARD 800 HAS BEEN FULLY ASSEMBLED AND ANCHORED IN PLACE. T-TOP IS REQUIRED WHEN THE BARRIERGUARD 800 IS USED AS A MDS, ANCHORED EVERY 20FT [6m], GATE SECTIONS AND VARIABLE LENGTH BARRIERS. THE T-TOP SHOULD EXTEND 40FT [12m] ON EITHER SIDE OF THESE CONDITIONS AND BE TERMINATED WITH TRANSITIONS.

11. THE BARRIERGUARD 800 RANGE HAS BEEN DESIGNED TO BE USED ON AND HAS BEEN TESTED ANCHORED ON ASPHALT, CONCRETE, GRANULAR SURFACES. SEE ANCHORAGE REQUIREMENTS TABLE OR CONTACT HIGHWAY CARE FOR FURTHER INFORMATION.

12. BARRIERGUARD 800 COMPONENTS ARE MANUFACTURED IN SI [METRIC] UNITS. ENGLISH UNITS SHOWN ARE APPROXIMATE. ALL COMPONENTS ARE FULLY GALVANIZED.

13. FOR TECHNICAL ASSISTANCE AND APPLICATION SUPPORT PLEASE CONTACT HIGHWAY CARE, LTD. ON EITHER (702) 204-0732 OR (702) 341-7374, ALTERNATIVLY EMAIL: sam.arnold@highwaycare.com <mailto:sam.arnold@highwaycare.com>, OR engineering@highwaycare.com <mailto:engineering@highwaycare.com>

14. BARRIERGUARD 800 SYSTEMS SHALL BE ASSEMBLED AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS DETAILED DRAWINGS, PROCEDURES AND SPECIFICATIONS. FOR ANY INSTALATIONS OUTSIDE OF THE SCOPE OF THESE DRAWINGS PLEASE CONTACT HIGHWAY CARE LTD FOR DETAILS.

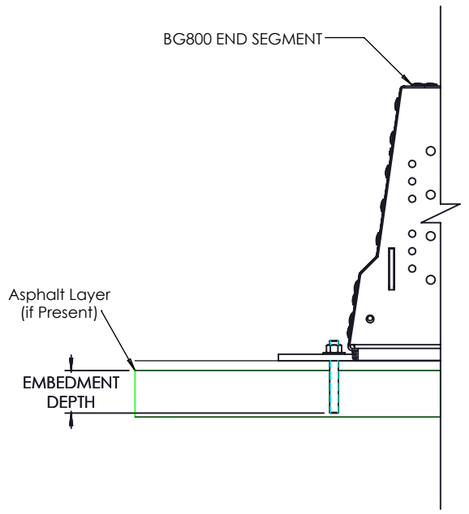
15. THIS DRAWING PROVIDES DETAILS OF THE TEMPORARY INSTALLATION OF BARRIERGUARD 800 & BARRIERGUARD 800 MDS ON STRUCTURES.

15. BARRIERGUARD 800 SYSTEM IS DESIGNED TO BE USED IN EITHER PERMINANT OR TEMPORARY APPLICATIONS.

Anchoring Requirements* - Structures

	Concrete	Unreinforced Concrete	Shallow Anchor In Concrete/ Unreinforced Concrete**	Asphalt/ sub base
Anchor Diameter	1 in.	1 in.	0.625 in.	1 in.
	[24mm]	[24mm]	[16mm]	[24mm]
Embedment Depth Into Concrete	6 in	8 in	4 1/8 in.	16 in
	[150 mm]	[200 mm]	[105 mm]	[400 mm]
Drill Diameter	1.125 in	1.125 in	1.1875 in	1.125 in
	[28mm]	[28mm]	[30mm]	[28mm]

* ALTERNATIVE ANCHORS ARE ALSO AVAILABLE, PLEASE REFER TO BG-60-23 OR CONTACT HIGHWAY CARE LTD FOR DETAILS.
** 2 OFF M16 REQUIRED TO REPLACE 1 OFF M24 ANCHOR.



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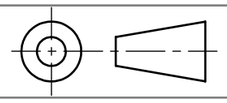

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Highway Care Ltd

Rev.	Details.	Dwn.	Date.	Ch'k'd	App'd
A	Drawing Release	BRC	31/01/14	AB	AB
B	Drawing Updated	BRC	07/02/14	AB	AB

Title: BARRIERGUARD 800 - PENNSYLVANIA DOT DRAWINGS

Project:

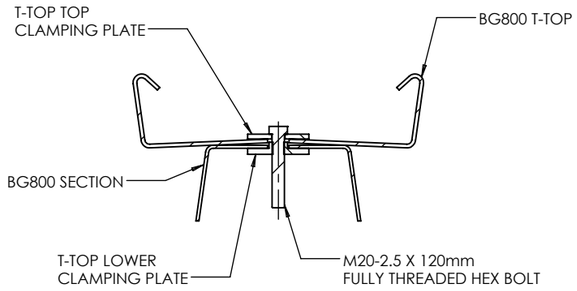
DWG No. BG-62-03

ISO A3 Landscape | DO NOT SCALE

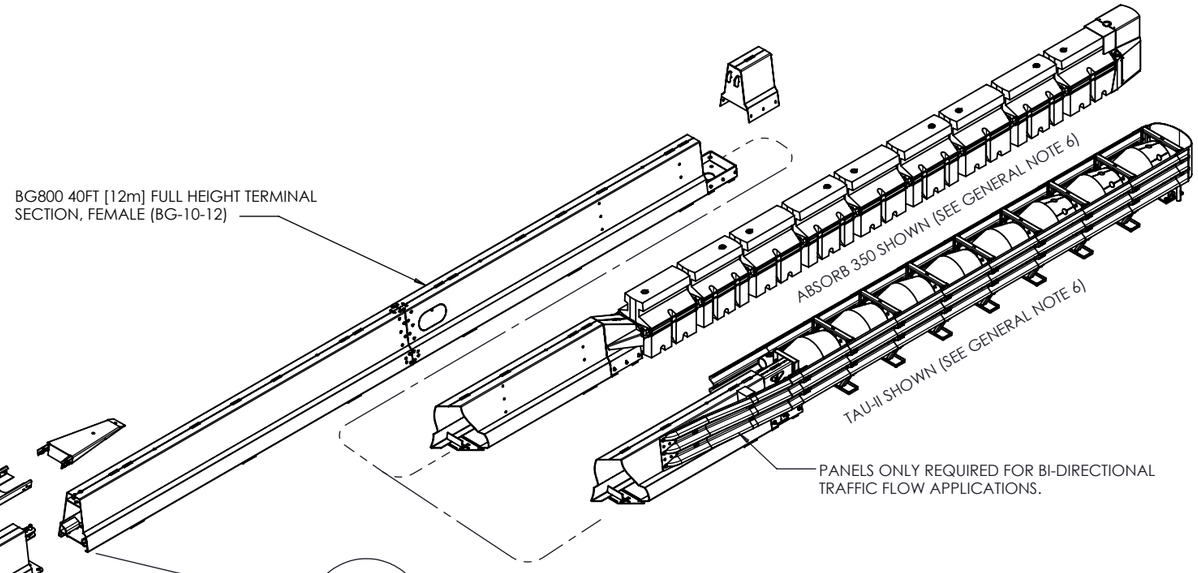
Revision B | Status Released

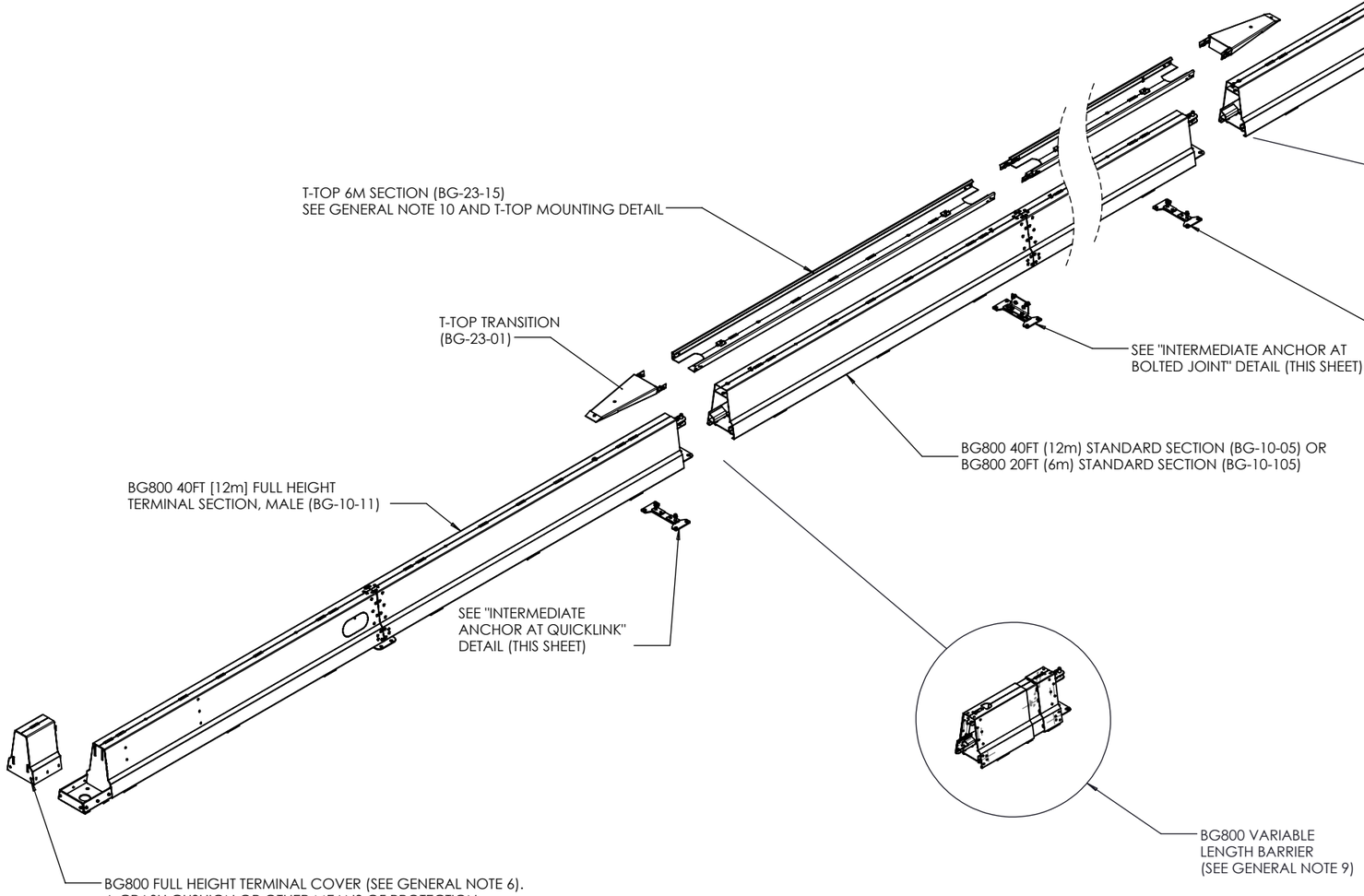
SHEET 1 OF 17

BARRIERGUARD 800 COMPONENTS IDENTIFICATION LAYOUT



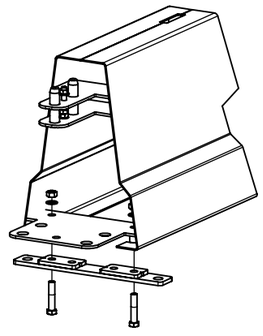
T-TOP MOUNTING DETAIL



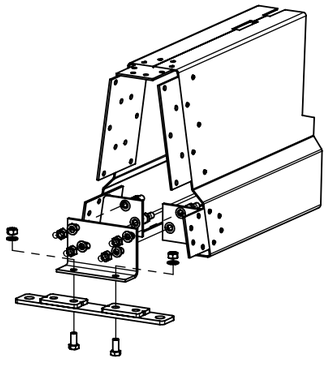


THE FOLLOWING COMPONENTS CAN BE USED WHEN THE SYSTEM FOLLOWS A CURVE IN A ROAD. (SEE SHEET 5 FOR DETAILS).
BG-10-302 - BG800 5° LH
BG-10-303 - BG800 5° RH
BG-10-304 - BG800 10° LH
BG-10-305 - BG800 10° RH

INTERMEDIATE ANCHOR IS USED FOR MINIMAL DEFLECTION SYSTEMS ANCHORED EVERY 20FT [6m] OR 40FT [12m]. BEFORE THE BG800 SECTIONS ARE DEPLOYEED TO THE GROUND, THE INTERMEDIATE ANCHORS MUST BE ATTACHED AT EACH QUICKLINK OR BOLTED JOINT. (SHOWN HERE AT QUICKLINK)

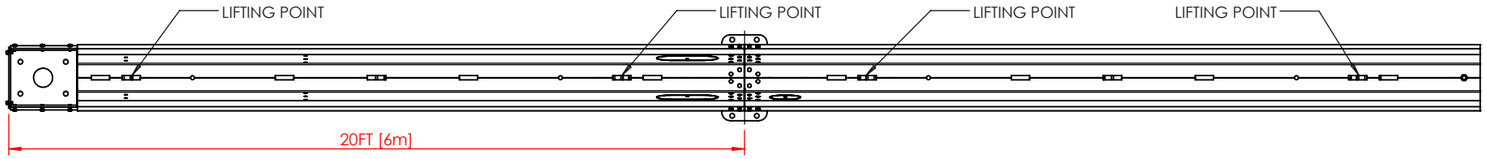


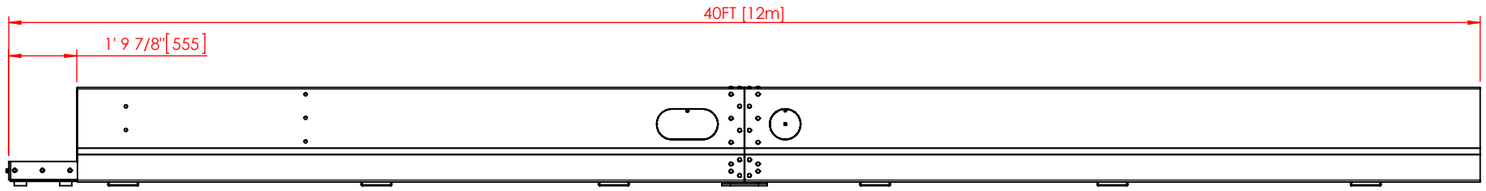
INTERMEDIATE ANCHOR AT QUICKLINK



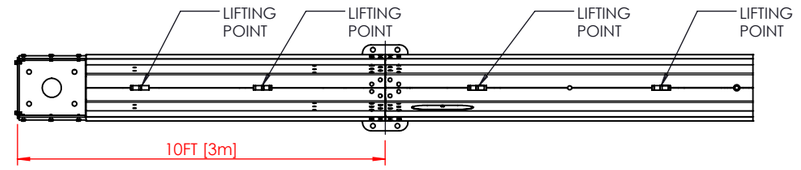
INTERMEDIATE ANCHOR AT BOLTED JOINT

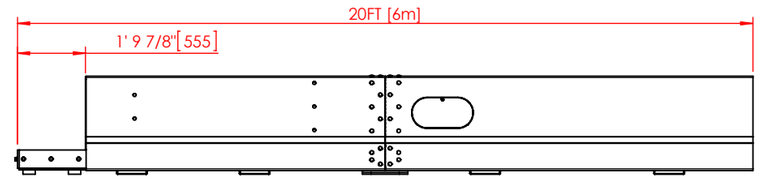
Highway Care Ltd	Ensure drawing is the correct issue and release before using.		DWG No. BG-62-03	ISO A3 Landscape	DO NOT SCALE	
			SHEET 2 OF 17	Revision	B	Status Released



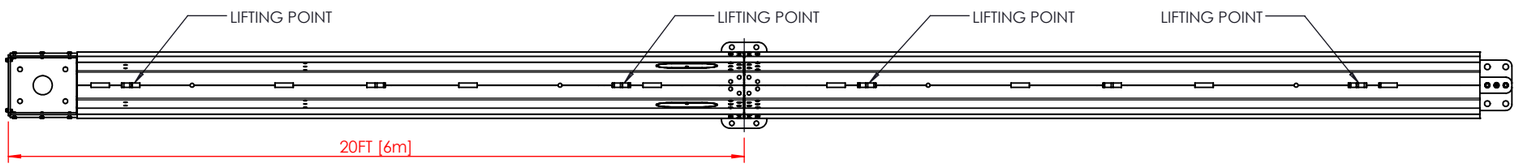


BG800 40FT (12m) FEMALE FULL HEIGHT TERMINAL (BG-10-12) WITH EXTERNAL ANCHOR SHOE (BG-11-01)

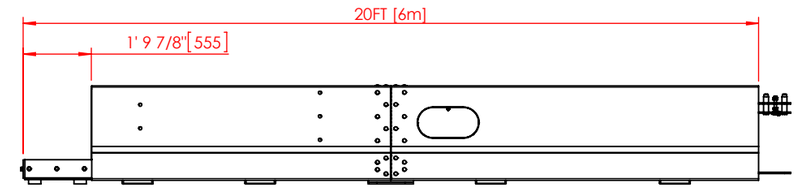




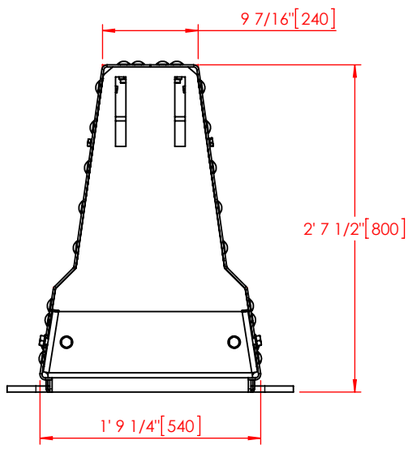
BG800 20FT (6m) FEMALE FULL HEIGHT TERMINAL (BG-10-112)
WITH EXTERNAL ANCHOR SHOE (BG-11-01)



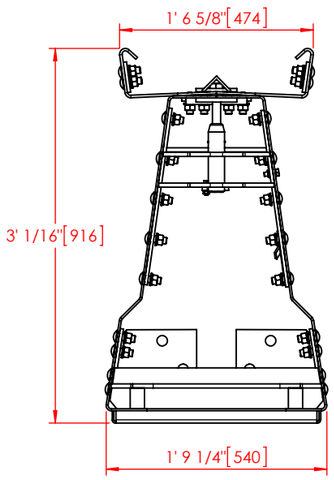
BG800 40FT (12m) MALE FULL HEIGHT TERMINAL (BG-10-11) WITH EXTERNAL ANCHOR SHOE (BG-11-01)



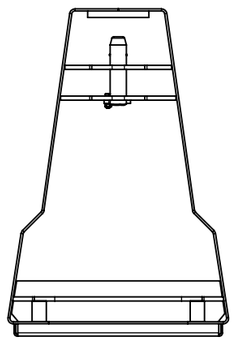
BG800 20FT (6m) MALE FULL HEIGHT TERMINAL (BG-10-111)
WITH EXTERNAL ANCHOR SHOE (BG-11-01)



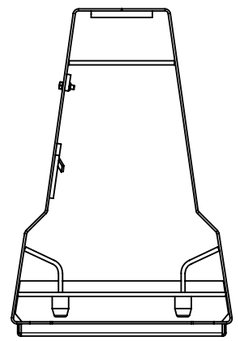
TYPICAL CROSS SECTION



TYPICAL CROSS SECTION WITH T-TOP

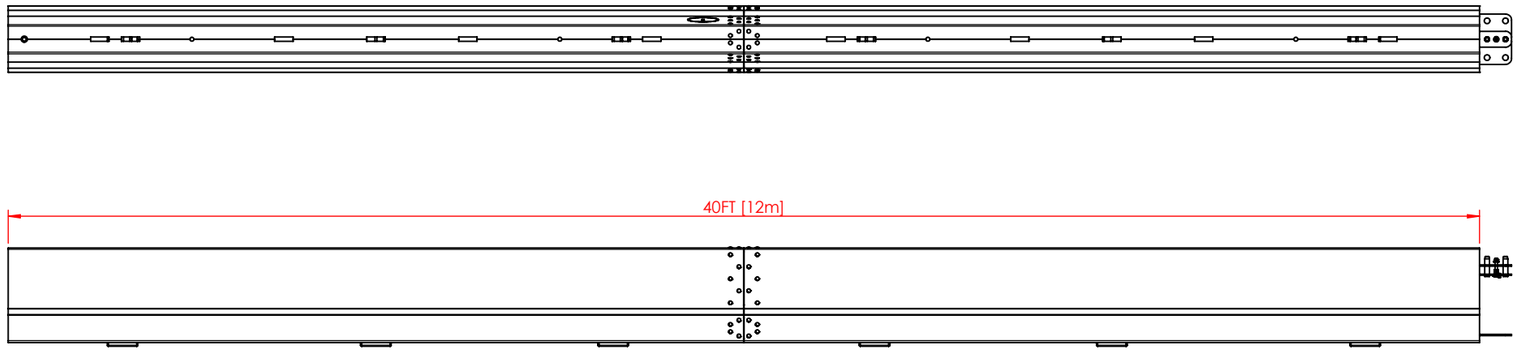


TYPICAL CROSS SECTION
MALE END

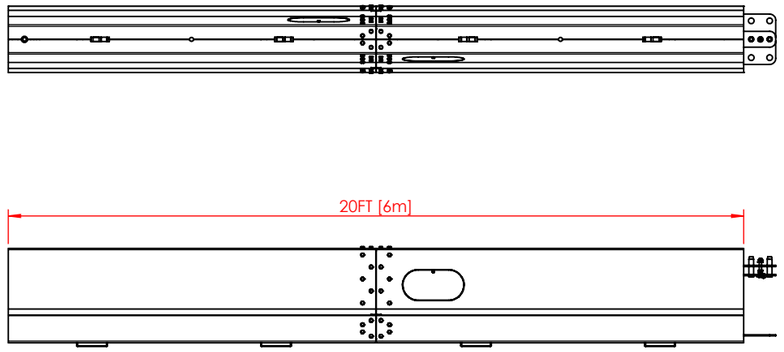


TYPICAL CROSS SECTION
FEMALE END

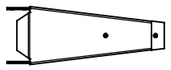
Highway Care Ltd	Ensure drawing is the correct issue and release before using.		*DWG No.* **BG-62-03** SHEET 3 OF 17	*ISO A3 Landscape*	DO NOT SCALE	
				Revision	**B**	*Status* Released

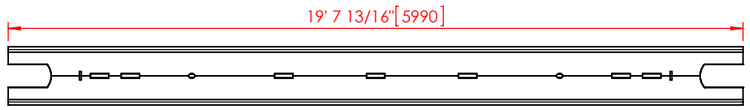


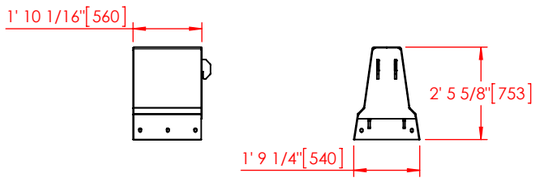
BG800 40FT [12m] STANDARD SECTION (BG-10-05)



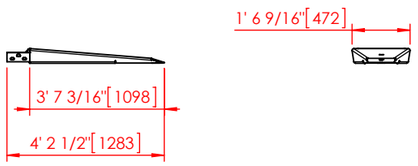
BG800 20FT [6m] STANDARD SECTION (BG-10-105)





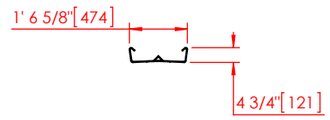


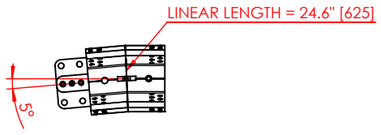
BG800 FULL HEIGHT TERMINAL COVER (BG-20-09)

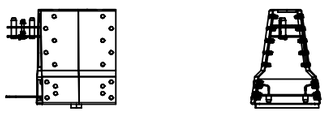


BG800 T-TOP TRANSITION (BG-23-01)

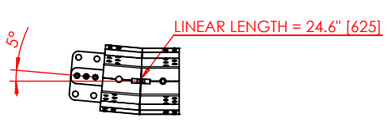
BG800 20FT [6m] T-TOP SECTION (BG-23-15)

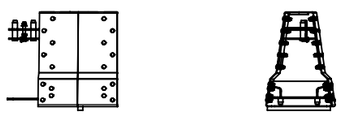




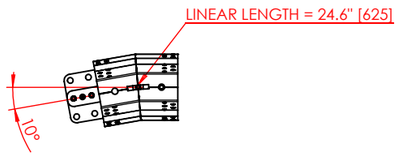


BG800 5° LH ANGLED SECTION (BG-10-302)

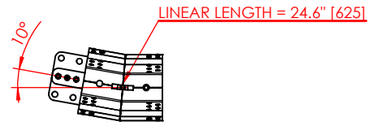




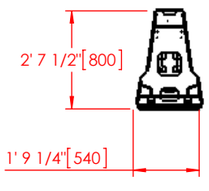
BG800 5° RH ANGLED SECTION (BG-10-303)

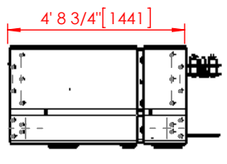


BG800 10° LH ANGLED SECTION (BG-10-304)

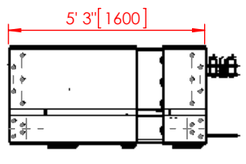


BG800 10° RH ANGLED SECTION (BG-10-305)

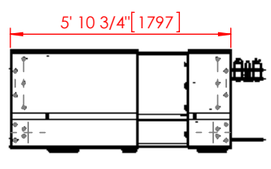




RETRACTED POSITION



NEUTRAL POSITION



EXTENDED POSITION

BG800 VARIABLE LENGTH BARRIER

Highway Care Ltd

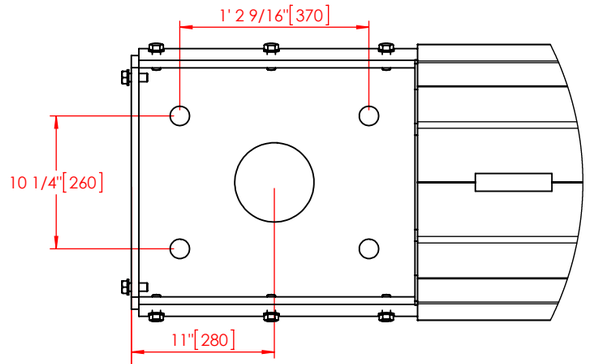
Ensure drawing is the correct issue and release before using.

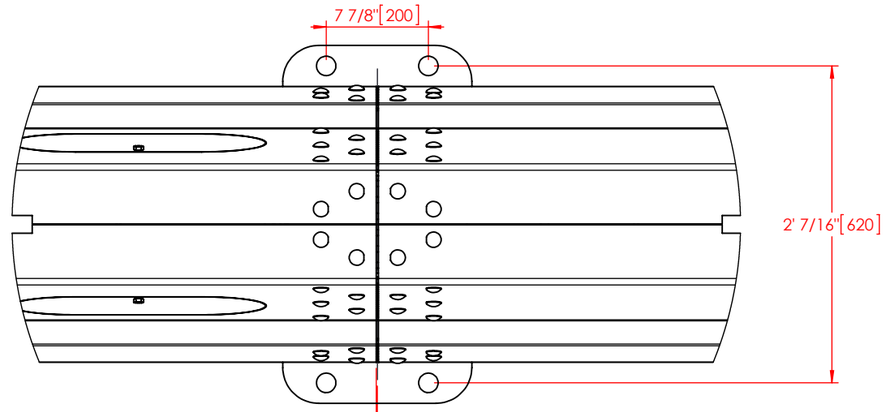
DWG No. BG-62-03

SHEET 4 OF 17

ISO A3 Landscape | DO NOT SCALE

Revision B | Status Released

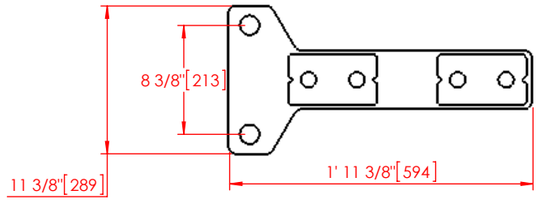




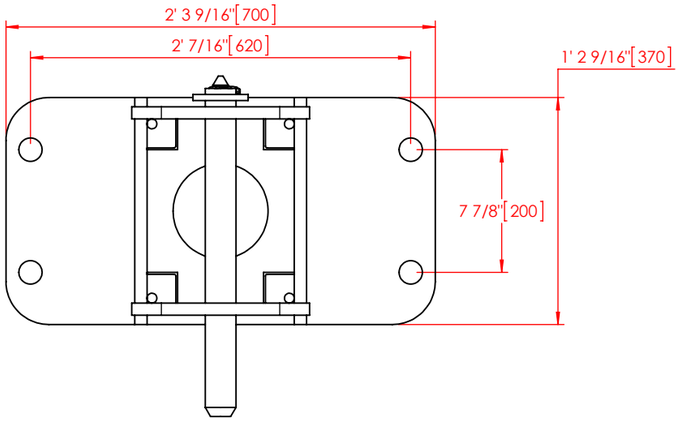
9' 10 1/8"[3000] FOR 20FT [6m] FULL HEIGHT TERMINAL

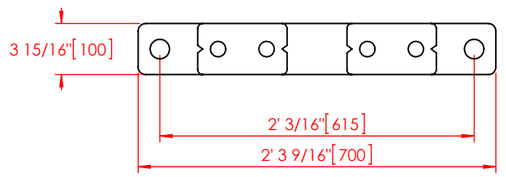
19' 8 1/4"[6000] FOR 40FT [12m] FULL HEIGHT TERMINAL

FULL HEIGHT TERMINAL - ANCHORING DETAIL.

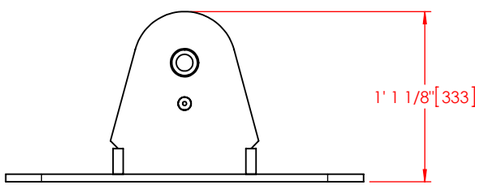


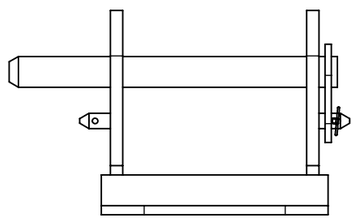
"SINGLE SIDED" INTERMEDIATE ANCHOR (BG-21-10)



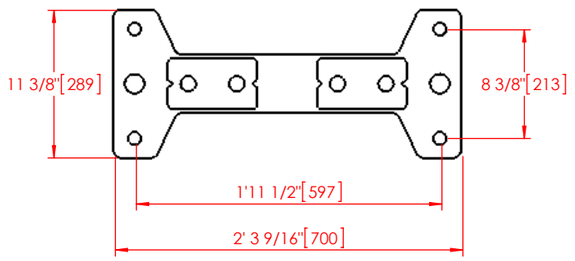


INTERMEDIATE ANCHOR (BG-21-06)



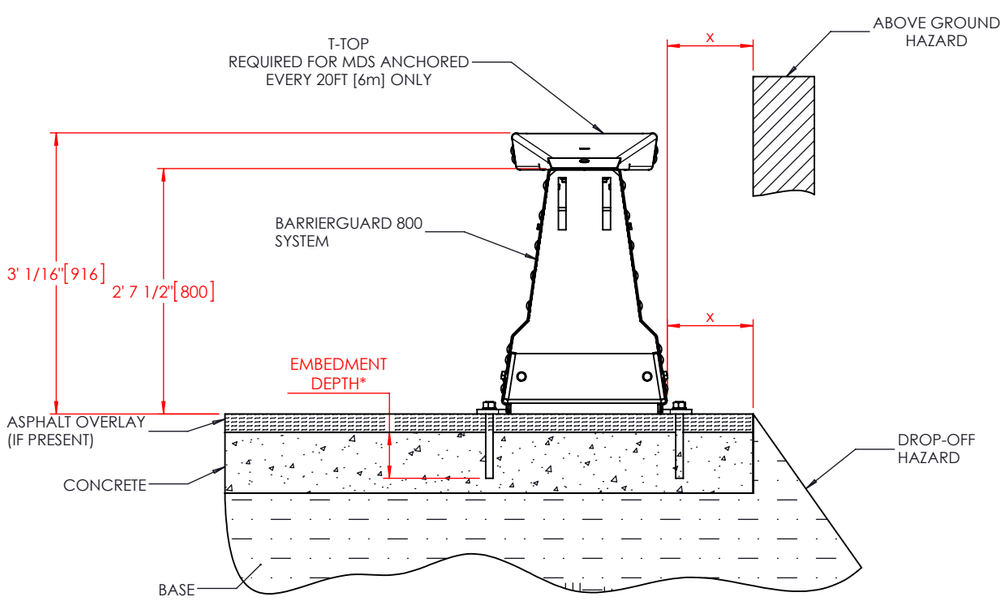


EXTERNAL ANCHOR SHOE ASSEMBLY (BG-11-01)

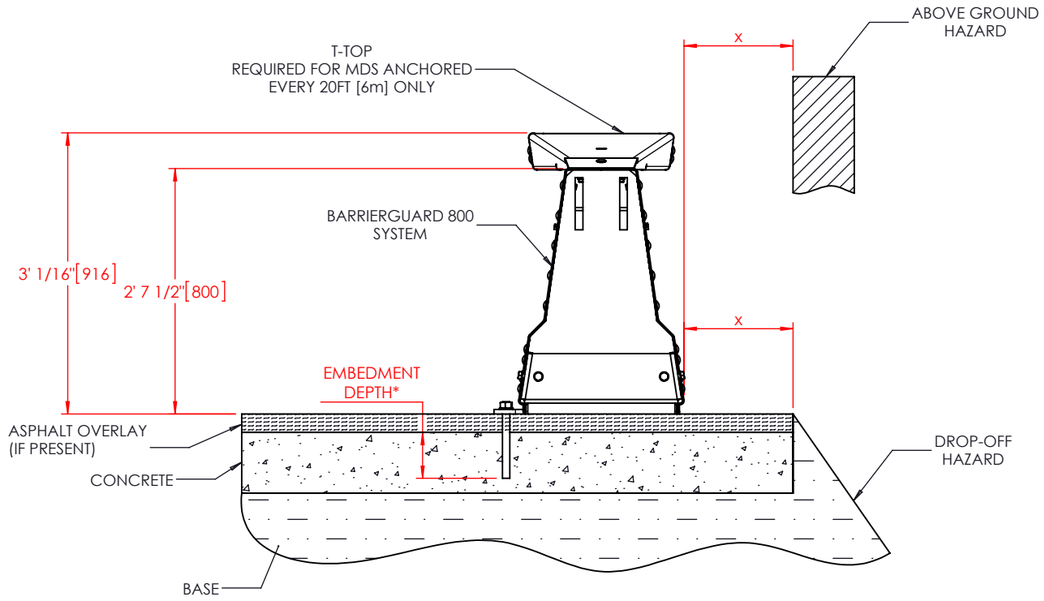


"BOW TIE 16mm" INTERMEDIATE ANCHOR (BG-21-23)

Highway Care Ltd	Ensure drawing is the correct issue and release before using.		*DWG No.* **BG-62-03**	*ISO A3 Landscape*	DO NOT SCALE		
			SHEET 5 OF 17	*Revision*	**B**	*Status*	Released



BARRIERGUARD 800 CONCRETE ANCHORING DETAIL

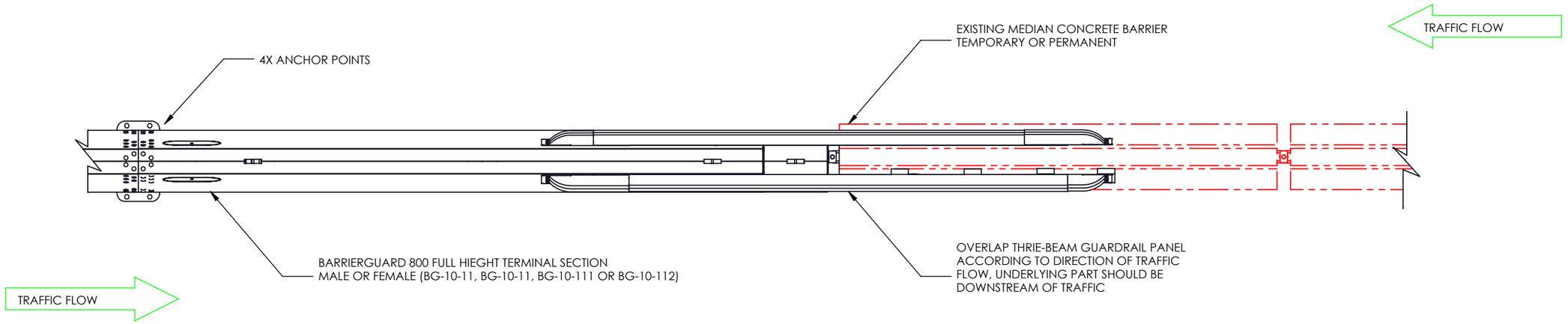


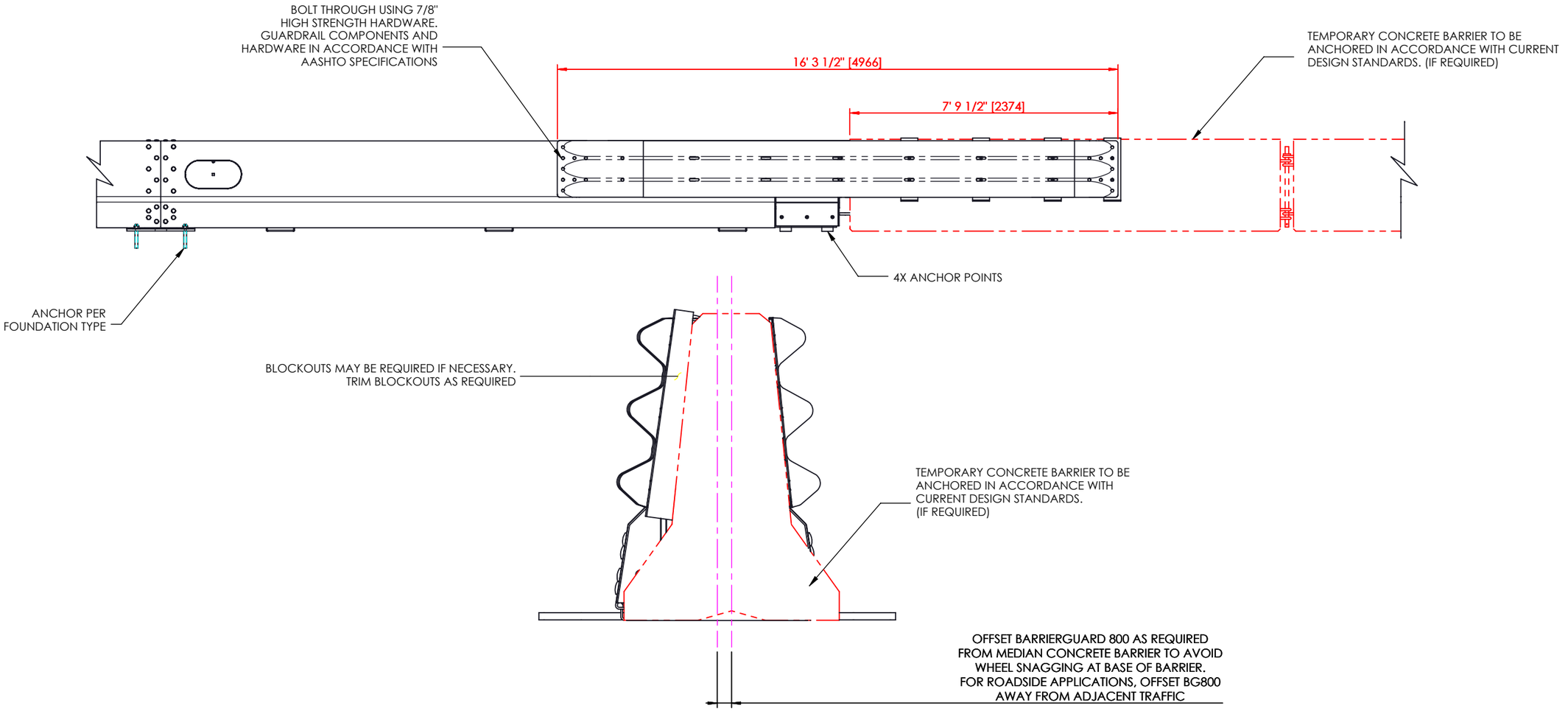
BARRIERGUARD 800 ALTERNATIVE SINGLE SIDED ANCHORING
CONCRETE ANCHORING DETAIL

NOTES:
*SEE ANCHORING REQUIREMENTS TABLES
SHEET 1 FOR EMBEDMENT DEPTH.

DEFLECTION REQUIREMENTS

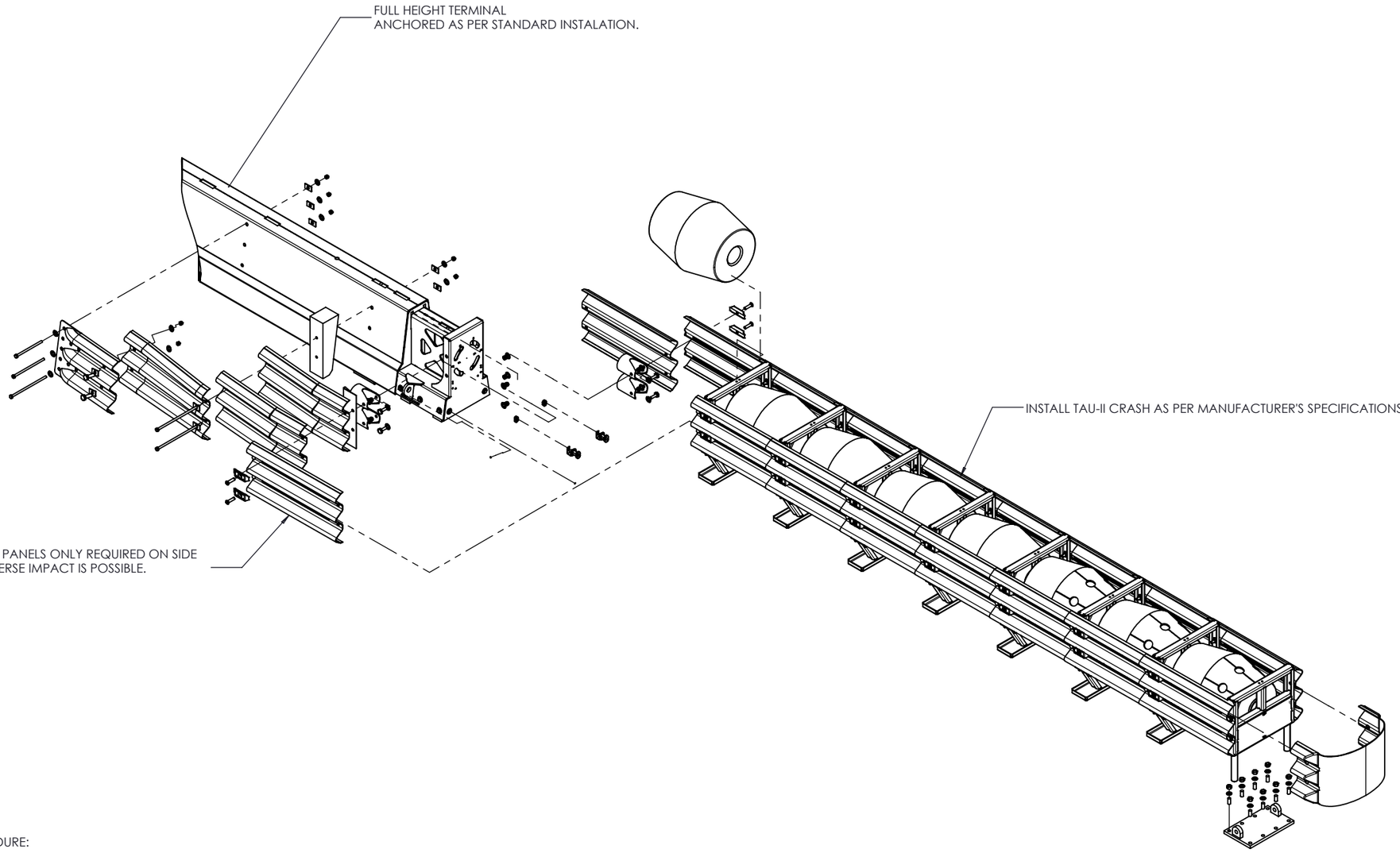
Instalation	Shielding/ Hazard	Work Zone Speed	Standard Installations Anchored on End Only No T-Top	MDS System Anchored every 40FT [12m] No T-Top	MDS System Anchored every 20FT [6m] With T-Top Standard Anchor Detail	MDS System Anchored every 20FT [6m] With T-Top Single Sided Anchor Detail
			DEFLECTION SPACE (X)	DEFLECTION SPACE (X)	DEFLECTION SPACE (X)	DEFLECTION SPACE (X)
Right Shoulder Application	Above Ground Hazards	45 mph or Less	2' 8 5/16" [820mm]	1' 5 11/16" [450mm]	3" [76mm] FOR HAZARDS AT GROUND LEVEL 5 1/2" [140mm] FOR ANY HAZARD ABOVE 1' [305mm]	3" [76mm] FOR HAZARDS AT GROUND LEVEL 5 1/2" [140mm] FOR ANY HAZARD ABOVE 1' [305mm]
		50 mph or Greater	5' 3" [1600mm]	2' 11 1/16" [890mm]	3" [76mm] FOR HAZARDS AT GROUND LEVEL 1' [305mm] FOR ANY HAZARD ABOVE 1' [305mm]	3" [76mm] FOR HAZARDS AT GROUND LEVEL 1' [305mm] FOR ANY HAZARD ABOVE 1' [305mm]
	Drop-off Hazards	45 mph or Less	1' 10 7/16" [570mm]	7 7/8" [200mm]	8" [203mm]	1" [25mm]
		50 mph or Greater	4' 5 1/8" [1350mm]	2' 1 3/16" [640mm]	8" [203mm]	1" [25mm]
Seperating Traffic Application	Adjacent Opposing Traffic	45 mph or Less	2' 8 5/16" [820mm]	1' 5 11/16" [450mm]	3" [76mm]	N/A
		50 mph or Greater	5' 3" [1600mm]	2' 11 1/16" [890mm]	3" [76mm]	N/A





Highway Care Ltd	Ensure drawing is the correct issue and release before using.		*DWG No.* **BG-62-03** SHEET 7 OF 17	*ISO A3 Landscape*	DO NOT SCALE		
				Revision	**B**	*Status*	Released

NOTES:
1) THE UNIVERSAL TAU-II CRASH CUSHION I S MANUFACTURED BY BARRIER SYSTEM INC. CONTACT BARRIER SYSTEMS INC VIA WWW.BARRIERSYSTEMSINC.COM
2) TRANSITION PANELS ARE ONLY REQUIRED WHEN TRAFFIC IS APPROACHING FROM DOWNSTREAM OF THE CUSHION.

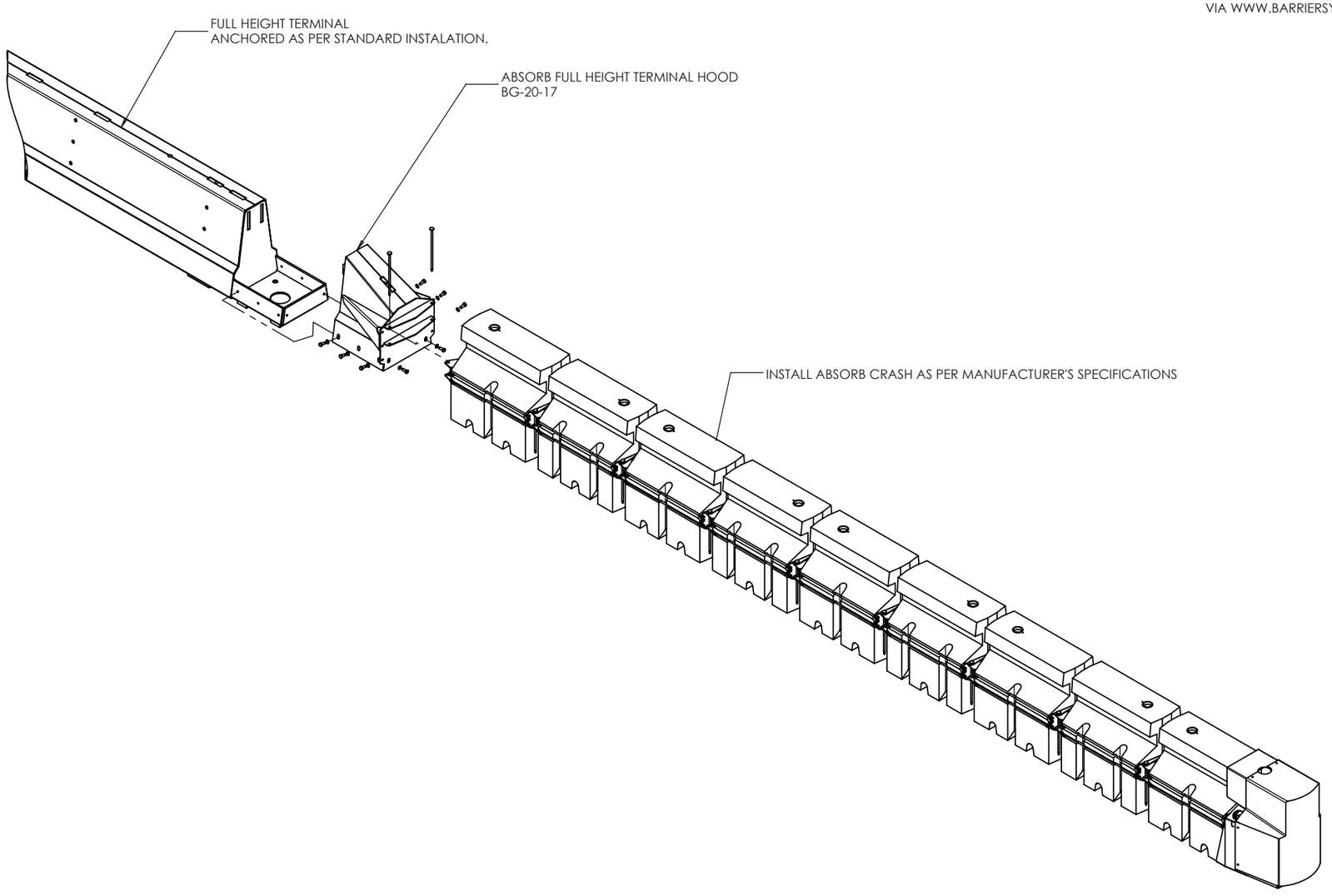


INSTALLATION PROCEDURE:

1)INSTALL AND ANCHOR THE BARRIERGUARD 800 FULL HEIGHT TERMINAL.
2)LIFT ON AND BOLT UP THE TAU-II FULL HIEGHT TERMINAL COVER.
3) INSTALL THE UNIVERSAL TAU-II CRASH CUSHION AS PER THE MANUFACTURERS INSTRUCTIONS.
4)IF REQUIRED - INSTALL THE TRANSITIONS PANELS.

Highway Care Ltd	Ensure drawing is the correct issue and release before using.		*DWG No.* **BG-62-03**	*ISO A3 Landscape*	DO NOT SCALE		
			SHEET 8 OF 17	*Revision*	**B**	*Status*	Released

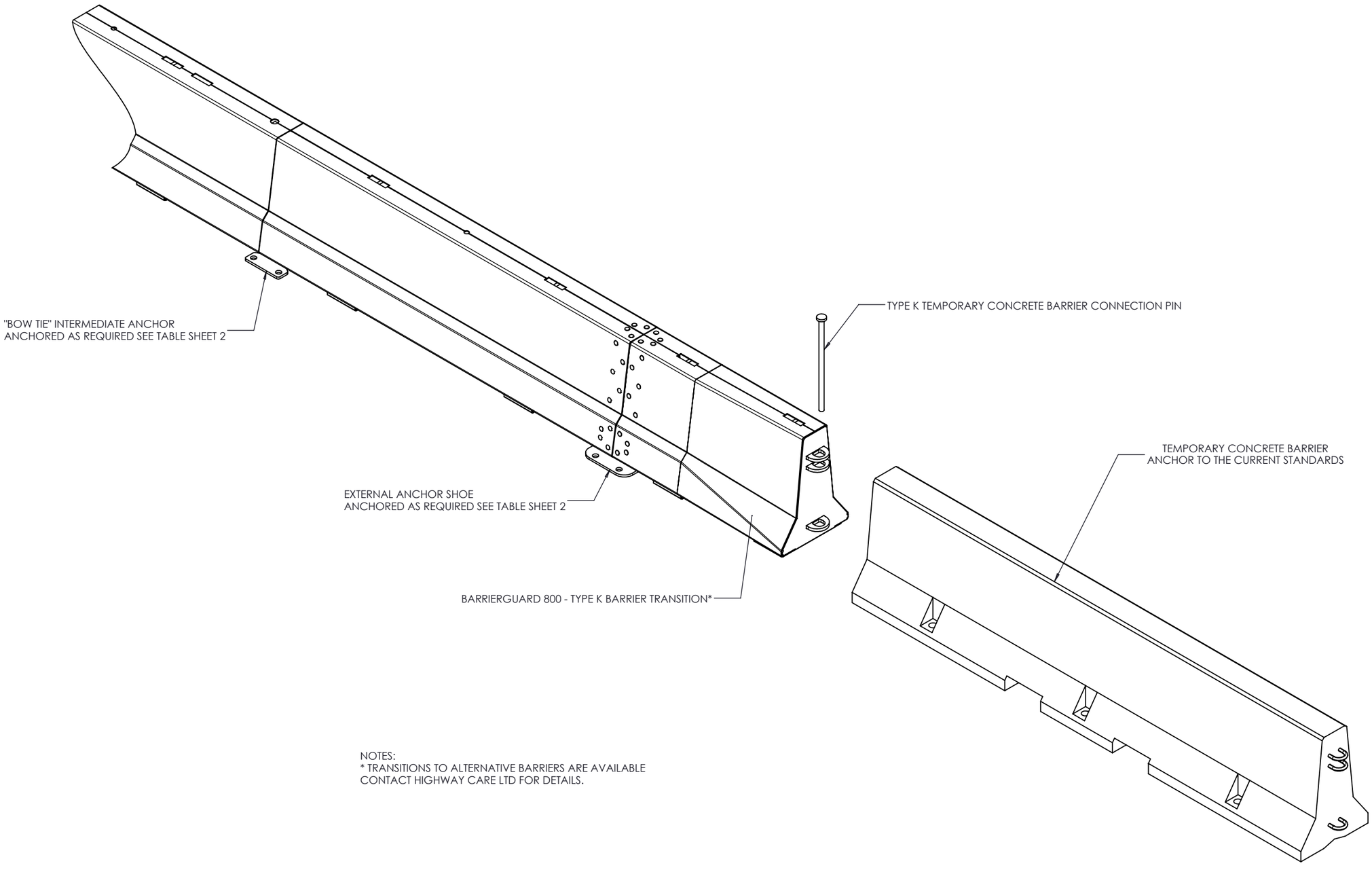
NOTES:
1) THE ABSORB CRASH CUSHION I S MANUFACTURED BY BARRIER SYSTEM INC. CONTACT BARRIER SYSTEMS INC VIA WWW.BARRIERSYSTEMSINC.COM



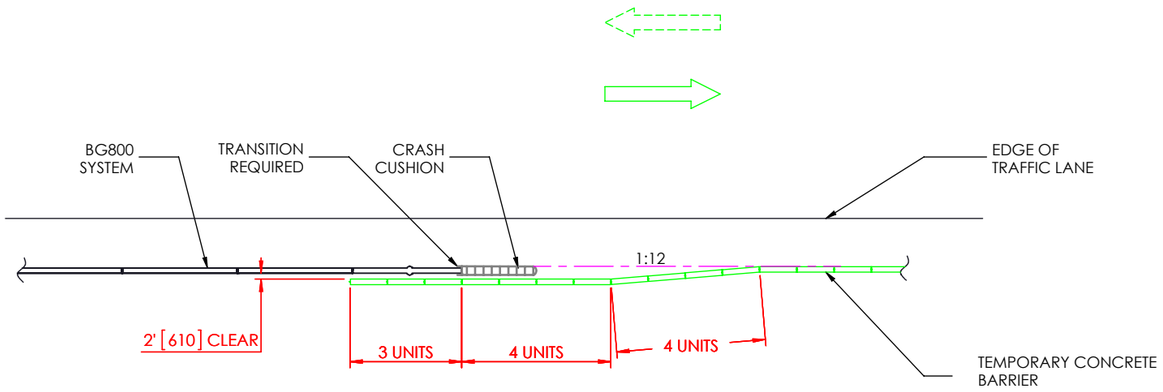
INSTALLATION PROCEDURE:

1)INSTALL AND ANCHOR THE BARRIERGUARD 800 FULL HEIGHT TERMINAL.
2)LIFT ON AND BOLT UP THE ABSORB FULL HIEGHT TERMINAL COVER.
3) INSTALL THE ABSORB CUSHION AS PER THE MANUFACTURERS INSTRUCTIONS.

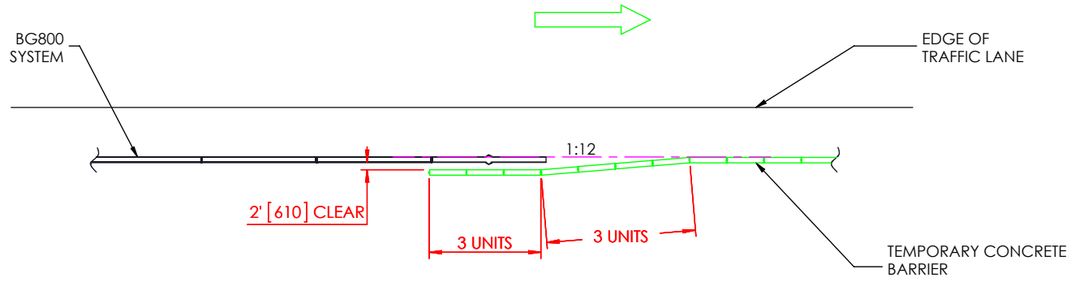
Highway Care Ltd	Ensure drawing is the correct issue and release before using.		*DWG No.* **BG-62-03**	*ISO A3 Landscape*	DO NOT SCALE	
			SHEET 9 OF 17	*Revision*	**B**	*Status* Released



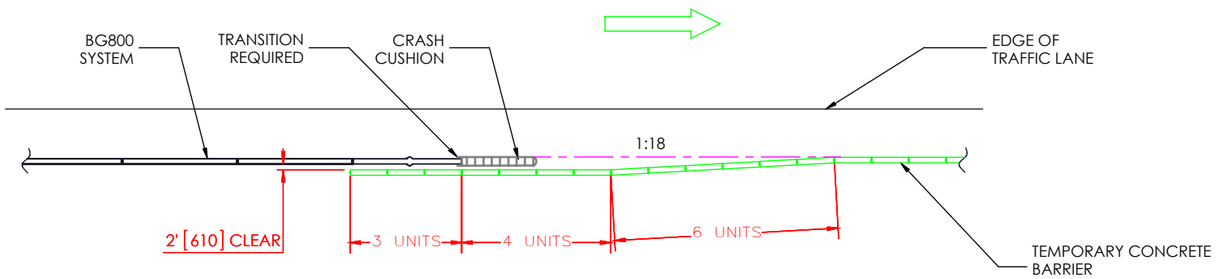
NOTES:
* TRANSITIONS TO ALTERNATIVE BARRIERS ARE AVAILABLE
CONTACT HIGHWAY CARE LTD FOR DETAILS.



45 MPH OR LESS

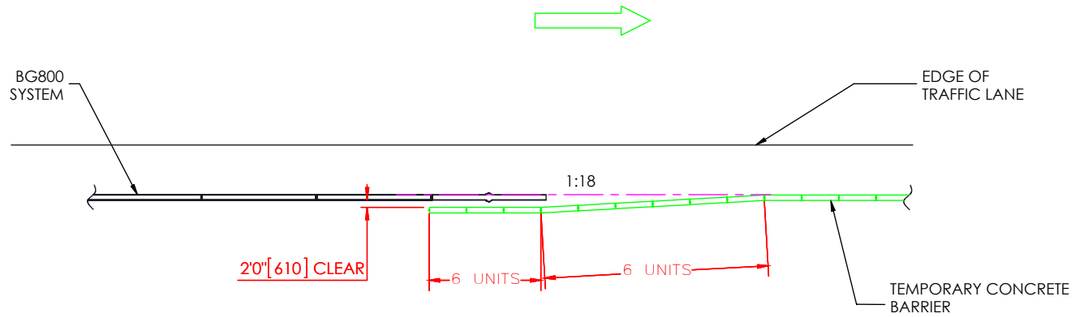


45 MPH OR LESS



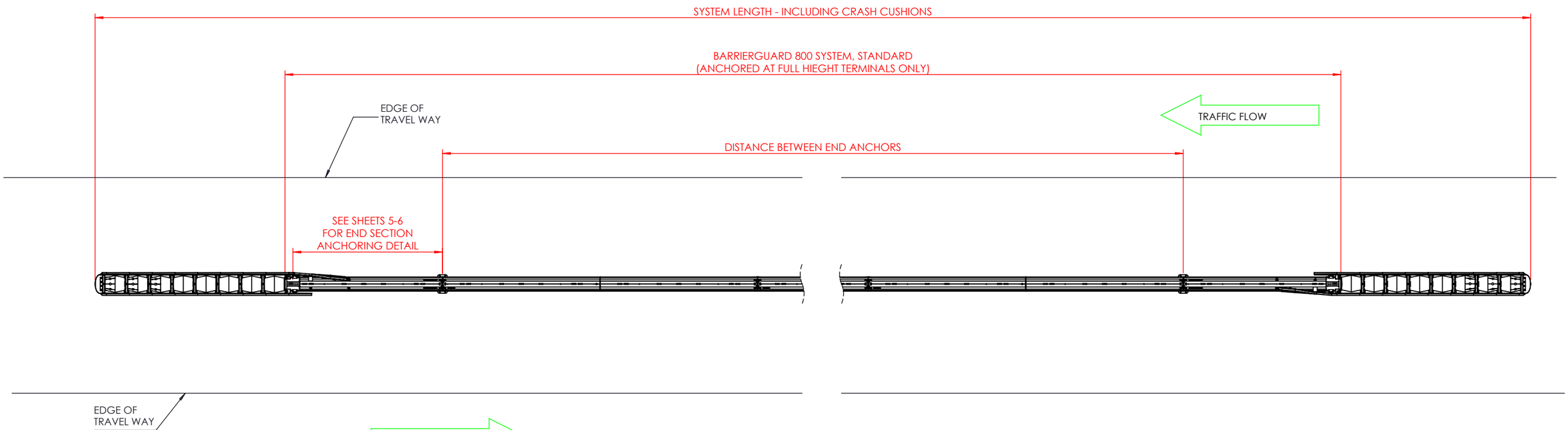
50 MPH OR GREATER

SHOULDER BARRIER ON UNDIVIDED FACILITIES

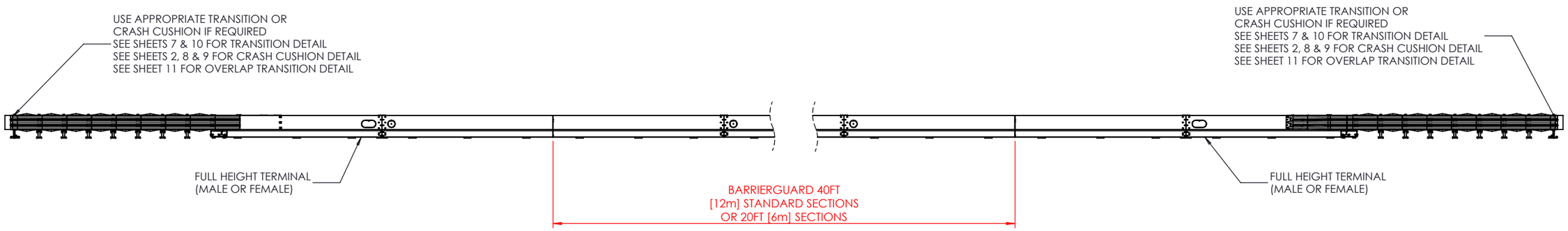


50 MPH OR GREATER

SHOULDER BARRIER ON DIVIDED FACILITIES

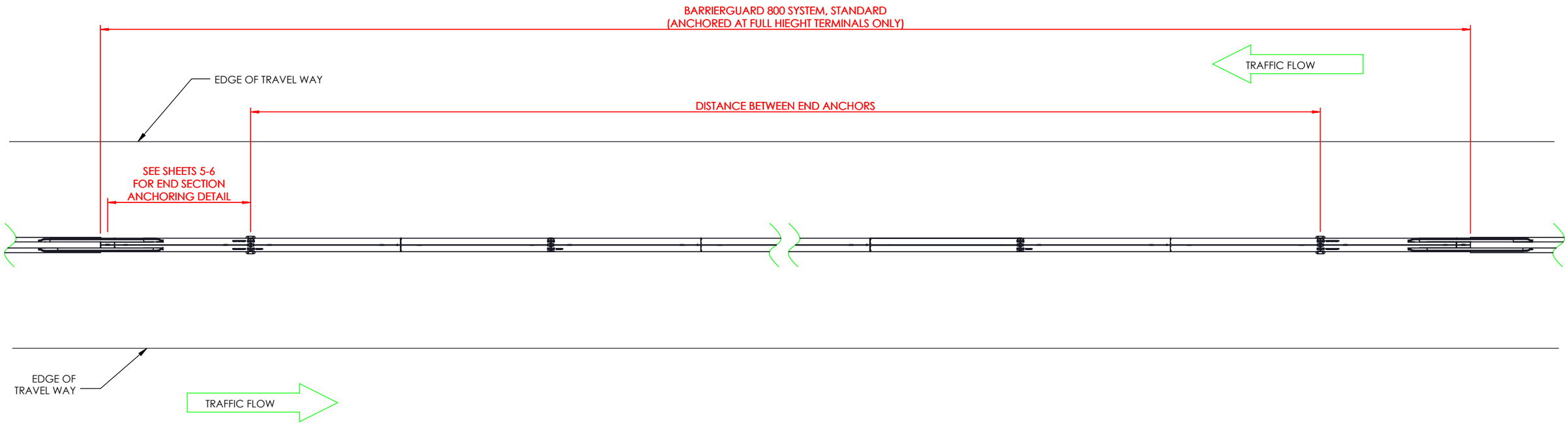


PLAN

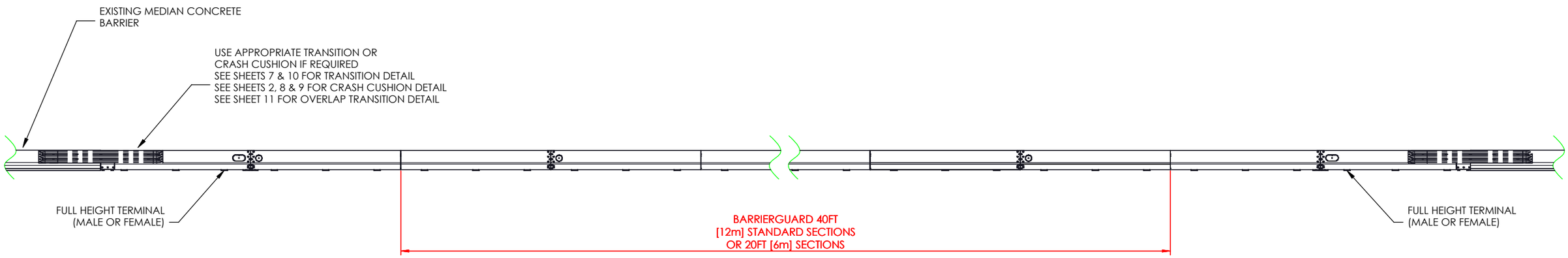


ELEVATION

Highway Care Ltd	Ensure drawing is the correct issue and release before using.		*DWG No.* **BG-62-03**	*ISO A3 Landscape*	DO NOT SCALE		
			SHEET 12 OF 17	*Revision*	**B**	*Status*	Released



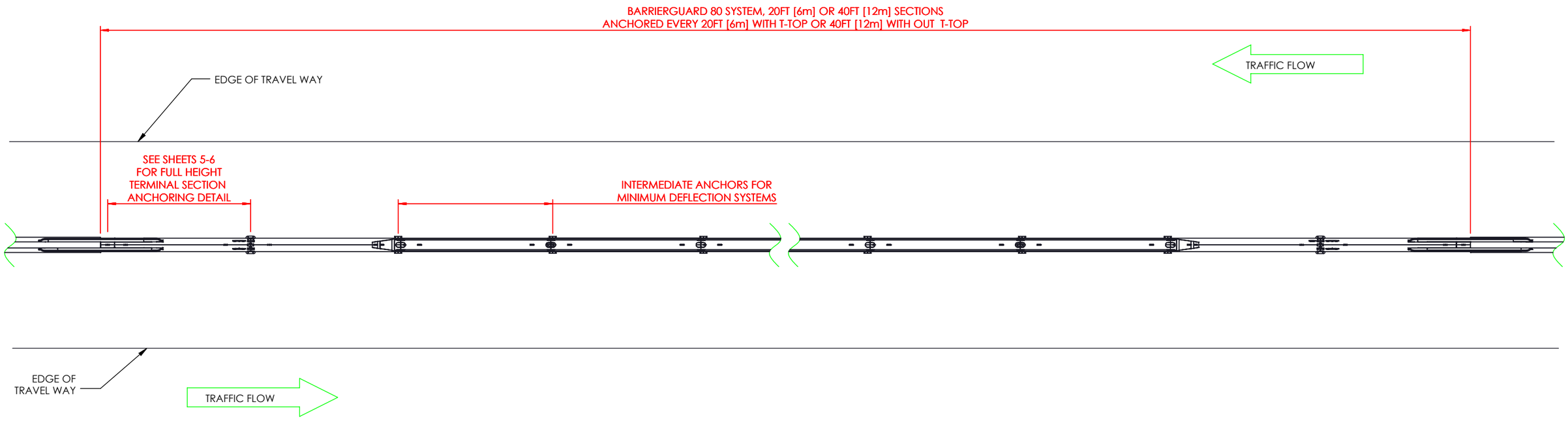
PLAN



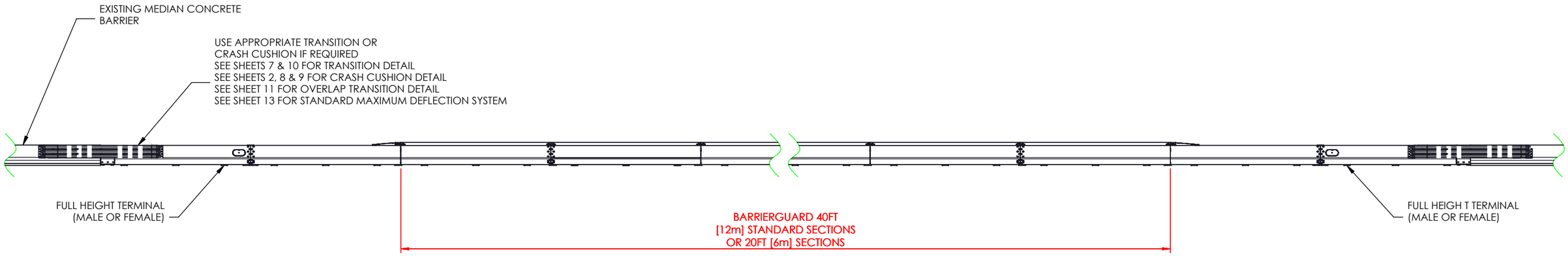
ELEVATION

BARRIERGUARD 800 STANDARD SYSTEM, MEDIAN APPLICATION

Highway Care Ltd	Ensure drawing is the correct issue and release before using.		*DWG No.* **BG-62-03**	*ISO A3 Landscape*	DO NOT SCALE		
			SHEET 13 OF 17	*Revision*	**B**	*Status*	Released



PLAN

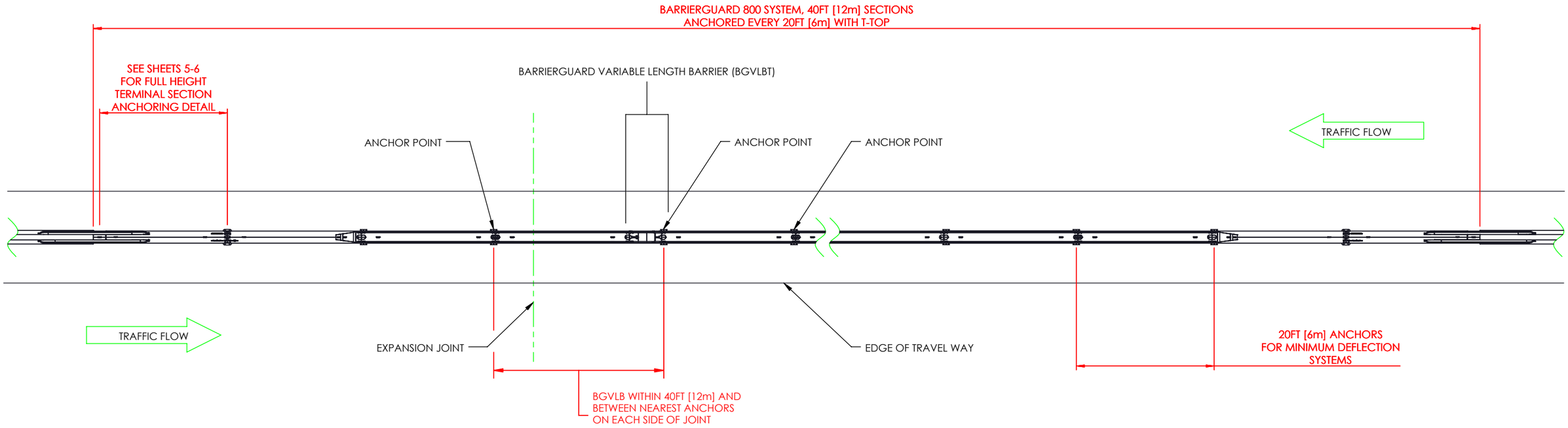


ELEVATION

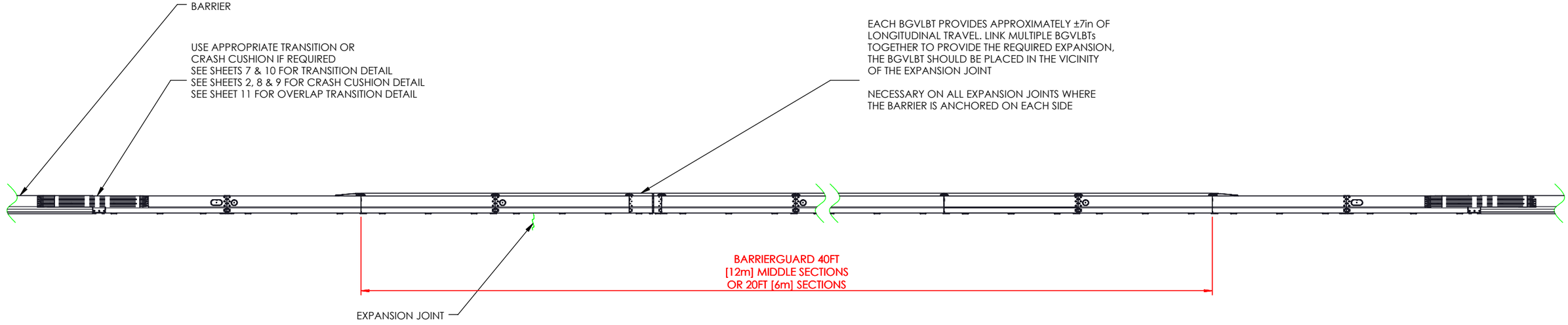
BARRIERGUARD 800 MINIMUM DEFLECTION SYSTEM, MEDIAN APPLICATION

(ANCHORED EVERY 20FT [6m] OR 40FT [12m]) -
DEPENDING ON MAXIMUM ALLOWABLE DEFLECTION

Highway Care Ltd	Ensure drawing is the correct issue and release before using.		*DWG No.* **BG-62-03**	*ISO A3 Landscape*	DO NOT SCALE		
			SHEET 14 OF 17	*Revision*	**B**	*Status*	Released



PLAN



ELEVATION

BARRIERGUARD 800 MINIMUM DEFLECTION SYSTEM WITH BARRIERGUARD VARIABLE LENGTH BARRIER (BGVLBT) FOR APPLICATIONS WITH EXISTING EXPANSION JOINT

WHERE BARRIER IS LOCATED
WITHIN CLEAR ZONE OF OPPOSING
TRAFFIC, APPROACH TRANSITION IS
REQUIRED

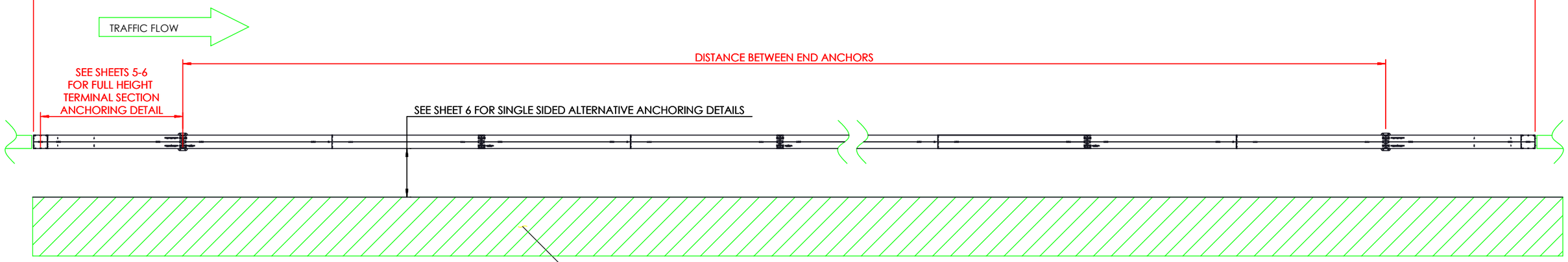
BARRIERGUARD 800 SYSTEM, STANDARD.
ONLY ANCHORED ON THE FULL HEIGHT TERMINAL SECTIONS

TRAFFIC FLOW

DISTANCE BETWEEN END ANCHORS

SEE SHEETS 5-6
FOR FULL HEIGHT
TERMINAL SECTION
ANCHORING DETAIL

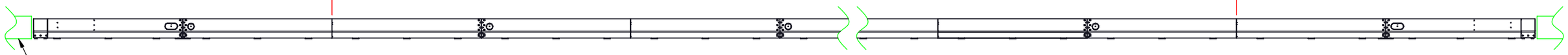
SEE SHEET 6 FOR SINGLE SIDED ALTERNATIVE ANCHORING DETAILS



DROP-OFF OR HAZARD

PLAN

BARRIERGUARD 40FT
[12m] STANDARD SECTIONS
OR 20FT [6m] SECTIONS*



ELEVATION

A CRASH CUSHION OR APPROPRIATE TRANSITION
OF OTHER MEANS OF PROTECTION SHOULD BE
INSTALLED AT END OF BARRIERGUARD 800 SYSTEM,
DIRECTLY IN FRONT OF ONCOMING TRAFFIC. CRASH
CUSHION SHOULD BE INSTALLED ON BOTH ENDS OF
SYSTEM LOCATED BETWEEN BIDIRECTIONAL TRAFFIC
OR APPROPRIATE TRANSITION APPLIED.

BARRIERGUARD 800 STANDARD SYSTEM, ROAD SIDE NEXT TO DROP-OFF OR HAZARD

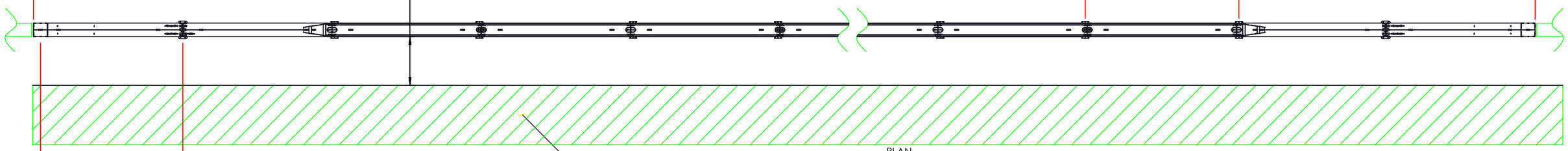
WHERE BARRIER IS LOCATED WITHIN CLEAR ZONE OF OPPOSING TRAFFIC, APPROACH TRANSITION IS REQUIRED

BARRIERGUARD 800 SYSTEM, 40FT [12m] SECTIONS ANCHORED EVERY 20FT [6m] WITH T-TOP

TRAFFIC FLOW

SEE SHEET 6 FOR SINGLE SIDED ALTERNATIVE ANCHORING DETAILS

20FT [6m] ANCHORS OR 40FT [12m] FOR MINIMUM DEFLECTION SYSTEMS

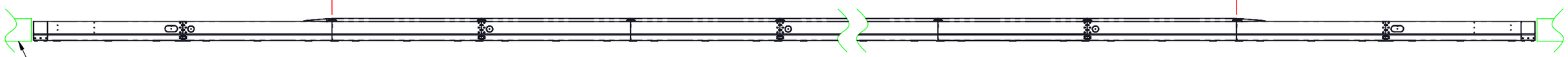


PLAN

SEE SHEETS 5-6 FOR FULL HEIGHT TERMINAL SECTION ANCHORING DETAIL

DROP-OFF OR HAZARD

BARRIERGUARD 40FT [12m] STANDARD SECTIONS OR 20FT [6m] SECTIONS



ELEVATION

A CRASH CUSHION OR APPROPRIATE TRANSITION OF OTHER MEANS OF PROTECTION SHOULD BE INSTALLED AT END OF BARRIERGUARD 800 SYSTEM, DIRECTLY IN FRONT OF ONCOMING TRAFFIC. CRASH CUSHION SHOULD BE INSTALLED ON BOTH ENDS OF SYSTEM LOCATED BETWEEN BIDIRECTIONAL TRAFFIC OR APPROPRIATE TRANSITION APPLIED.

BARRIERGUARD 800 MINIMUM DEFLECTION SYSTEM, ROAD SIDE NEXT TO DROP-OFF OR HAZARD